Innovations

THE UNIVERSITY OF TEXAS AT SAN ANTONIO COLLEGE OF ENGINEERING

VOL. 16 | FALL 2013

Stem Cells and Undergraduates:

Students, like Marissa Wechsler, are advancing the fields of engineering through undergraduate research programs at UTSA.

UTSA Engineering

Correction:

Last issue we encouraged our alumni to reach out to us. We posted a photo (above) of Roland Rea and David Finnie. We mistakenly misspelled Roland's last name. We are sorry for the error and have re-run the photo with caption on the back of the magazine.

On the bright side, we do see that alumni are reading our magazine and reaching out to us. We, at the College of Engineering, would love for our alumni to get in touch with us. Let us tell your story and inspire engineering students to follow in your footsteps. Or, share with us some of the pitfalls you found along the way and help up-and-coming engineers avoid those same mistakes.

Email Tim.Luukkonen@utsa.edu.

ON THE COVER

Biomedical engineering student, Marissa Wechsler, works in Dr. Rena Bizios' lab doing research into stem cell technology and how it can be used to regenerate missing sections of human bone through electrical current.

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editorial

A message from the Interim Dean of the College of Engineering

Mehdi Shadaram, Ph.D., P.E.
Briscoe Distinguished Professor
David and Jennifer Spencer Distinguished Dean's Chair in Engineering

It is with great pleasure to introduce to you the fall 2013 edition of *Innovations*. On behalf of all faculty, staff and students in the College of Engineering at UTSA, I appreciate your interest and support of this wonderful college. In the late spring of 2013, Dr. Mauli Agrawal, after seven years of outstanding service to the College of Engineering as dean, was appointed as interim vice president for research at UTSA. Under his leadership, the College of Engineering flourished considerably and was transformed into a full-fledged research and teaching institution. It is a great honor for me to serve as the interim dean while the search for a permanent dean is currently underway. It is important for me to assure you that the momentum of our college will continue building.

To push our students to excel academically, over the last several years, undergraduate research programs have become part of the student learning process. Many of our undergraduates, along with faculty and graduate students, work in research laboratories on a variety of topics ranging from structural and finite element analyses to stem cells. To further promote undergraduate research, the college created the Undergraduate Research Award, and the winners of this year's awards are Jessica George, Andrew Shiels, and Jonathan Lwowski.

Within the scope of undergraduate research, engineering students, in collaboration with graduate students and students from the College of Sciences and College of Education and Human Development, have developed a virtual training system that uses real-time wireless feedback to measure data on the mechanics of football kicking. Their work has been supported by the College of Engineering's Center for Simulation, Visualization, and Real Time Prediction (SiViRT) and funded by the National Science Foundation (NSF). Undergraduate research like this has enabled our students to understand their fields of study, promoted team work, and prepared them for the challenges of graduate school.

Since last year, several professors have received prestigious research funding awards from agencies such as the NSF, National Institutes of Health, and Department of Defense totaling more than $7 million, and the annual research expenditure in our college reached nearly $14 million. Additionally, the College of Engineering has raised over $2.6 million in gifts and endowments towards UTSA's efforts on becoming a Tier One institution. Each year, the college receives financial support from a variety of organizations and individuals in support of scholarships and educational activities. The latest donation, a generous contribution from the family of Dee Howard, a legend of the aviation industry in San Antonio, has created an endowment to promote aerospace engineering. And earlier this year, GreenStar Products, Inc. of San Antonio established the GreenStar Endowed Professorship in Energy for the benefit of the College of Engineering.

With so many exciting things happening within the College of Engineering, I invite all of you to visit our web page (engineering.utsa.edu) and see for yourselves what events we have coming up. And please, next time you are in San Antonio, stop by and share your thoughts and experiences with us. We would love to hear your feedback.

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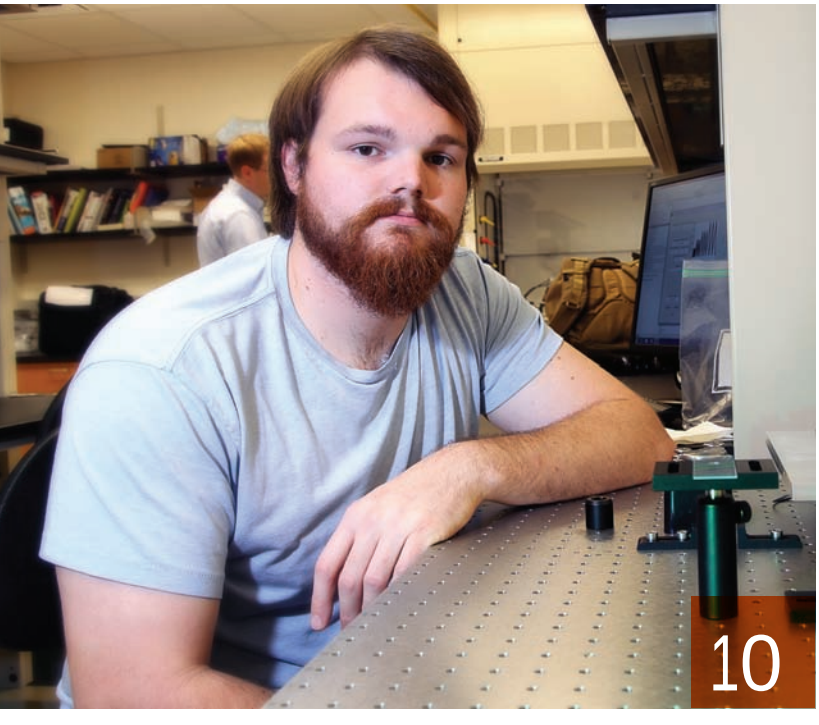

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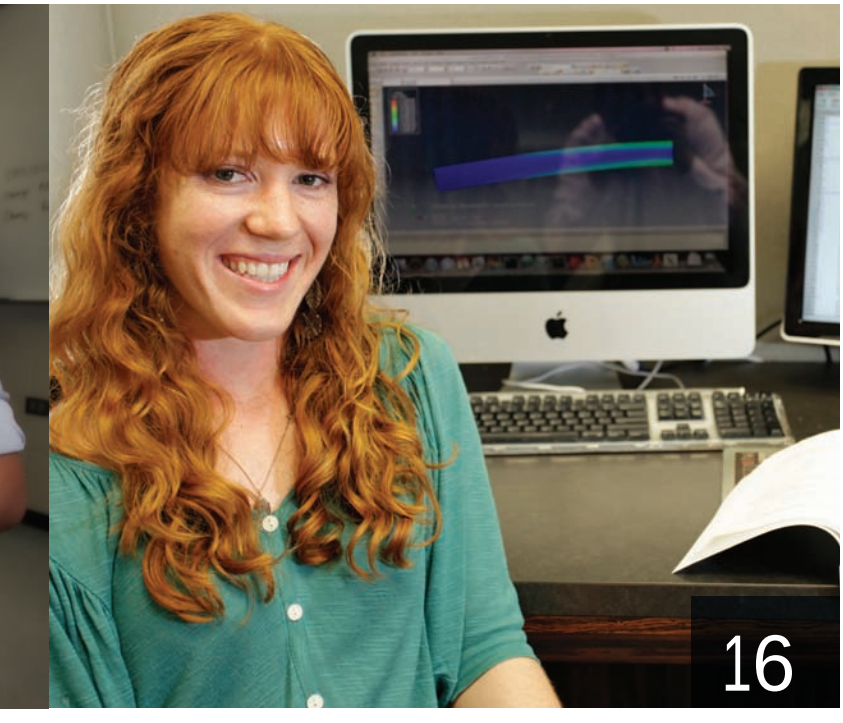

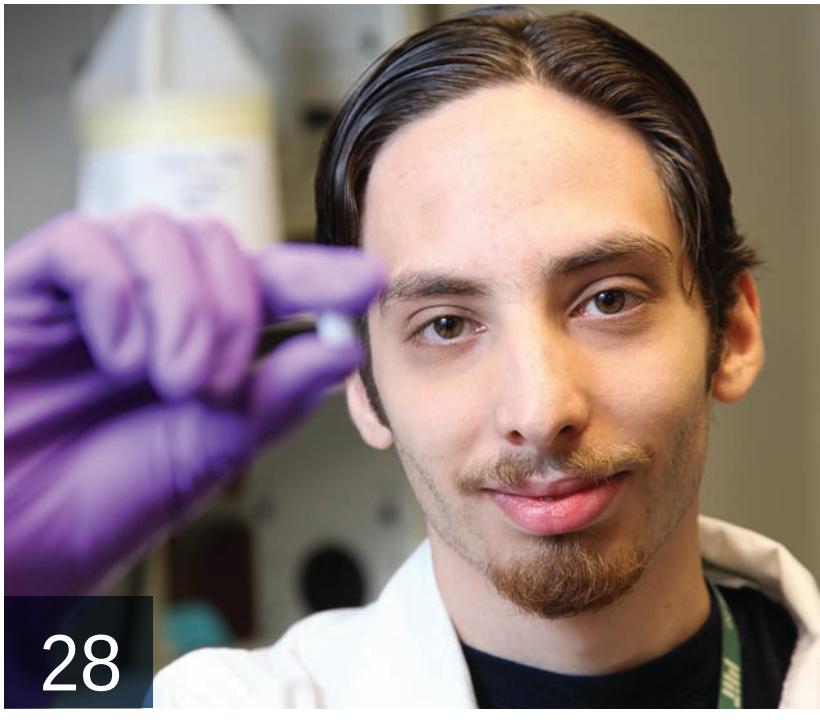

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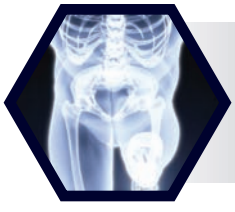


Solving the "fragility" issues in the healthcare industry

Dr. Xiaodu Wang received a National Science Foundation grant for more than $250,000 to study causes of bone fragility and will work with graduate students—Jitin Samuel and Anne Sheldrake.

Nationally, there are an estimated two million bone fractures occurring each year in the United States which cost upwards of $17 billion. Those most affected by bone fractures are elderly citizens. Bone fragility fractures are a major concern for the health care of elderly patients due to their high mortality/morbidity rates and the associated costs, especially on those with a fixed income.

As a natural composite material, ultrastructural changes in bone associated with skeletal disorders (e.g. osteogenesis imperfecta, osteopetrosis/osteomalacia, and osteoporosis) serve as major causes of such fractures. Recent evidence has indicated that the toughness of bone is dependent on three major mechanisms: i.e. damage accumulation (modulus loss), plastic flow, and viscous energy dissipations. Wang and his team of researchers hope to identify the underlying origins of these behaviors which are not only critical for fully understanding the nanomechanics of bone, but also for providing a mechanistic basis for guiding the development of therapeutic regimens that can specifically target these origins.

To address this extremely challenging, but high impact issue, they proposed a synergistic approach combining synchrotron X-ray scattering and unique mechanical testing techniques to simultaneously examine the mechanical behavior of bone at the nanoscopic and tissue levels. Using this experimental approach, they expect to establish a mechanistic framework to describe the behavior of bone constituents (i.e. mineral crystals and collagen fibrils) and its contribution to the bulk behavior (i.e. modulus loss, plastic deformation, and viscous response) of bone. The eventual goal of the study is to identify the nanoscopic origins of bone fragility.

UTSA partners with SACNAS to strengthen the STEM of the nation

UTSA was the first platinum sponsor for the Society for the Advancement of Chicanos/ Hispanics and Native Americans in Science (SACNAS) 40th anniversary conference.

Nearly 4,000 participants from around the country participated in this year's theme of "Strengthening the Nation through Diversity, Innovation and Leadership in STEM." Highlights included a speech by San Antonio Mayor Julián Castro, remarks by UTSA President Ricardo Romo, and 90 presentations by UTSA students and alumni.

Biomedical engineering was strongly represented with both undergraduate and graduate students winning for their research.

The winner in the Category of Bioengineering/ Biomedical engineering was undergraduate Claudio Macias for his work in "Modifying mechanical and bioactive properties of hydroxyapatite scaffolds via collagen coatings."

The winners in the Category of Bioengineering/ Biomedical engineering for graduate oral presentations were Damon Cardenas for his work in "Determination of the effects of hyperbaric conditions on CMRO2 in rats during forepaw stimulation using fMRI" and Justin Garcia for his research on "A structural analysis of twisted veins."

Expert in peridynamics

by KC Gonzalez

University of Texas at San Antonio researcher and assistant professor of mechanical engineering John Foster will play an important part in a $7.5 million Department of Defense contract to advance the understanding and use of a relatively new mathematical modeling theory called peridynamics, which allows scientists to more accurately predict material failure.

The five-year project will contribute to the advancement of a modeling and predictive simulation framework that will allow the technical community to better understand how heterogeneous materials behave under stress. This could allow for significant improvements in the safety and cost of materials that make up everything from airplanes and cars as well as assisting in energy production technology such as hydraulic fracturing. The project is part of the federal government's highly competitive Multidisciplinary University Research Initiative (MURI).

The MURI program supports research by teams of investigators that intersect several traditional science and engineering disciplines in order to accelerate research progress. The Air Force Office of Scientific Research (AFOSR) granted seven awards, totaling $67.5 million, to various academic institutions to perform multidisciplinary basic research.

"As UTSA continues toward a goal of becoming a top-tier research university, it is programs like the MURI that give us the proverbial seat at the table," said Foster. "The opportunity to attend and present at national program reviews with the high-profile visibility of a MURI and where other top-tier researchers are in attendance will only enhance the reputation of UTSA as a serious place for research. Hopefully, our success with this program will lead to similar opportunities in the future."

Foster, one of approximately two dozen people in the world who specialize in peridynamics, will collaborate with researchers at the University of Arizona, University of Nebraska-Lincoln, Pennsylvania State University and Arizona State University.

As a partner, UTSA will receive $959,153 over the next five years for direct research. The grant will provide additional support for travel, student collaboration and workshop organization.

Including the MURI grant, Foster has been awarded nearly $2 million in research grants since he joined UTSA in Fall 2011. Currently, he is also collaborating with researchers at the University of Texas at Austin to study hydraulic fracture modeling and with researchers at Johns Hopkins University on building materials that can withstand extreme environments.

UTSA's future in aviation begins with Dee Howard's legacy

Dee Howard is a legend of the aviation industry in San Antonio, Texas, and is internationally recognized for his development and certification of numerous aircraft safety and performance improvements, and refinements in aircraft flight characteristics.

Today, Howard's legacy lives on at The University of Texas at San Antonio through an endowment established by his children, Dee Ann Bridges and Lonnie Dean Howard. The permanent endowment in the Department of Mechanical Engineering will be used by the Dee Howard Faculty Fellow to advance research and scholarship in aerospace engineering.

With an additional $150,000 in gifts from other leaders in the community, the fellowship will be elevated to become a professorship, helping to attract an even higher level of expertise in aerospace engineering to strengthen the industry here in San Antonio.

NewsBytes

Students join inaugural undergraduate research summer initiative

Over the summer, the UTSA Office of Undergraduate Research and the Honors College partnered with the UTSA Center for Simulation, Visualization and Real-Time Prediction (SiViRT) to host UTSA's inaugural Undergraduate Research Summer Initiative.

This competitive eight-week initiative provided funding to 13 undergraduate students to engage in cross-disciplinary collaboration and research. The initiative was sponsored by the SiViRT Center with funding from the National Science Foundation.

The 13 outstanding undergraduate students truly represented multidisciplinary research and had backgrounds in engineering, kinesiology, computer science, mathematics, and chemistry.

"Many of these students had no idea that education experiences existed outside of their required lectures and lab courses," Dr. Donovan Fogt, director of Undergraduate Research said. "Their newfound confidence in their professional preparation exemplifies the need for undergraduate transformative experience opportunities. The impact of student experience outside of the classroom environment is unparalleled. While numerous research opportunities exist across campus, too few students know about them or understand the value of participation and learning how knowledge is created."

All of the faculty-mentored research projects were presented at the 2013 Student Research Expo with a goal of having undergraduate research initiatives at UTSA help undergraduate students engage in scholarly research to prepare them for graduate school.

Three days to start a company: Ready, Set, GO!

For the first time, The University of Texas at San Antonio hosted its own "3 Day Startup," (3DS) an intensive technology business experience that ran from 4 p.m., Friday, Oct. 25, through Sunday, Oct. 27.

Organized by UTSA student organization Collegiate Entrepreneurs Organization (CEO) with support from the UTSA Center for Innovation and Technology Entrepreneurship (CITE), 3DS at UTSA was designed with two specific goals in mind: kick-start new technology companies to the point where they are ready to enter business incubators or accept seed funding, and build entrepreneurial capabilities in students and the university community.

The concept behind 3 Day Startup is simple: start a scalable technology company over the course of three days. By the end of the fast-paced weekend, 28 students from different disciplines—business, computer science, design, engineering and liberal arts—were left standing.

Fueled by free food and caffeine, participants in 3DS spent an intense weekend brainstorming ideas, conducting market validation, devising business models, building prototypes, and pitching to actual investors and successful entrepreneurs. The result was an experience that inspires innovation by requiring participants to actually build and launch companies of their own.

Ideas that made it to the final round of pitches ranged from an app allowing restaurants to increase business through strategic coupon messaging to an engineering app that combines parts catalogs thus streamlining purchases.

New Faculty

Nikolaos Gatsis

Assistant Professor
in Electrical and Computer Engineering

Ph.D. — University of Minnesota

Originally from Patras, Greece, Nikolaos Gatsis comes to UTSA because it is one of the fastest-growing universities in the nation and has a strong program in his areas of interest—communication networks, smart grids, and engineering optimization. Specific research topics he has worked on include robust and risk-constrained renewable energy management, demand response scheduling for the smart grid, cross-layer optimization of wireless multi-hop networks, and power control for dynamic spectrum access networks. Currently, his focus is on robust and risk-constrained renewable energy management, where he hopes to effectively integrate more renewable energy sources into future smart grids.

Victor Maldonado

Assistant Professor in Mechanical Engineering

Ph.D. — Rensselaer Polytechnic Institute

Victor Maldonado was born in Guadalajara, Mexico, but grew up among the vineyards of Napa Valley, California. He's always had a desire to become a university professor and after several interviews with other universities, he knew he'd found a home at UTSA. The reason for coming here: he felt he had the greatest opportunity to make a positive impact in the rapidly growing mechanical engineering department and the student community. Within the department Maldonado teaches experimental fluid mechanics, flow control, aerodynamics, flight mechanics, and aircraft design. His research interests and activity lie primarily in multi-scale flow control; a discipline of fluid mechanics and a technique that he uses to improve the performance of aerodynamic systems, or systems where fluid flow is involved. When he isn't in the lab, he cultivates his love of travel with his passion for photography. He's visited and photographed remarkable structures like the Roman Coliseum and the Athenian Acropolis.

Breaking the Barriers on Who Should Do Research

How the College of Engineering supports undergraduates and their research endeavors.

Imagine for a moment being 19 years old, an undergraduate student in college and having the ability to work on research that could one day change the way we see the world—literally. For students in UTSA's College of Engineering, the chance to have such an impact is a reality. And for those eager to get out of the classroom and into the lab, the college is making it even easier.

"My present research involves studying the effects of age on the stiffness of lenses in the eye," said Andrew Shiels, a biomedical engineering sophomore. "The immediate application of this research is to corroborate and elaborate on existing data and literature. The long-term application though, at least as far as I'm concerned, is to explore the potential revelations that lens tissues hold in the development of implantable biomimetics."

By funding undergraduate research programs the College of Engineering is encouraging students to begin thinking in terms of graduate school, while exploring all the possibilities research has to offer.

The college encourages students to commit to the program for the entire academic year with a stipend of $3,500. Faculty mentors receive $1,000 to support their own research initiatives.

All of the research conducted has long-term applications and holds personal value for the students. This year's students are focusing on projects that involve paving the way for implantable biomimetics in the eye, the fate and transport of nanoparticles in water supplies, and unmanned aircraft used as robotic guidance systems.

For some of the students the work they've done has gone beyond the confines of a laboratory. Jessica George has taken advantage of the opportunities offered at UTSA to see how her research into water could change the lives of an entire community in Peru during an Engineers Without Borders trip.

"I am concerned about the water supply for my local community, as well as the world beyond," said George, a civil engineering senior. "I'm not sure about changing the world, but I've seen first-hand that a small group of determined people can assist in starting a well project for a Peruvian village to provide the most basic necessity for its inhabitants—water. Having a safe and dependable water system for a villager in Viña Vieja should be the norm someday in the future."

The mentors involved understand the value of the work being contributed by the students, and also acknowledge how much students gain from being involved in undergraduate research. They encourage students to further develop their abilities.

"Undergraduate research is not for everyone, but it is extremely important to those who excel in their academic work to 'stretch' their skills and knowledge," Dr. Daniel Pack said.

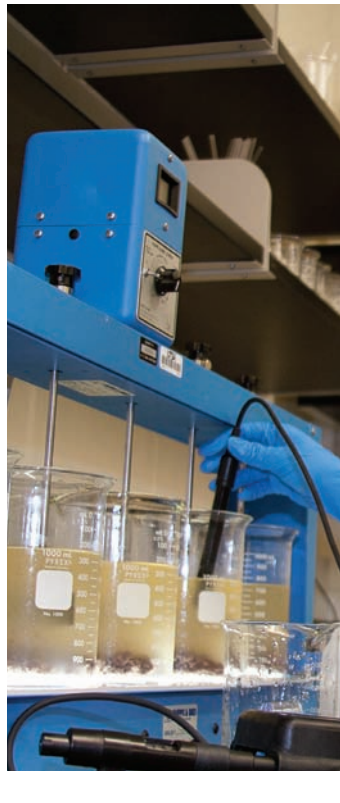
"Undergraduate research allows students to apply the principles they are learning in the classroom and become more engaged with their major and the university," added Dr. Heather Shipley. "The students' affiliation with research helps them to learn to identify and articulate fundamental principles and recognize questions still unanswered in the field. It also makes them competitive when they apply for graduate school."

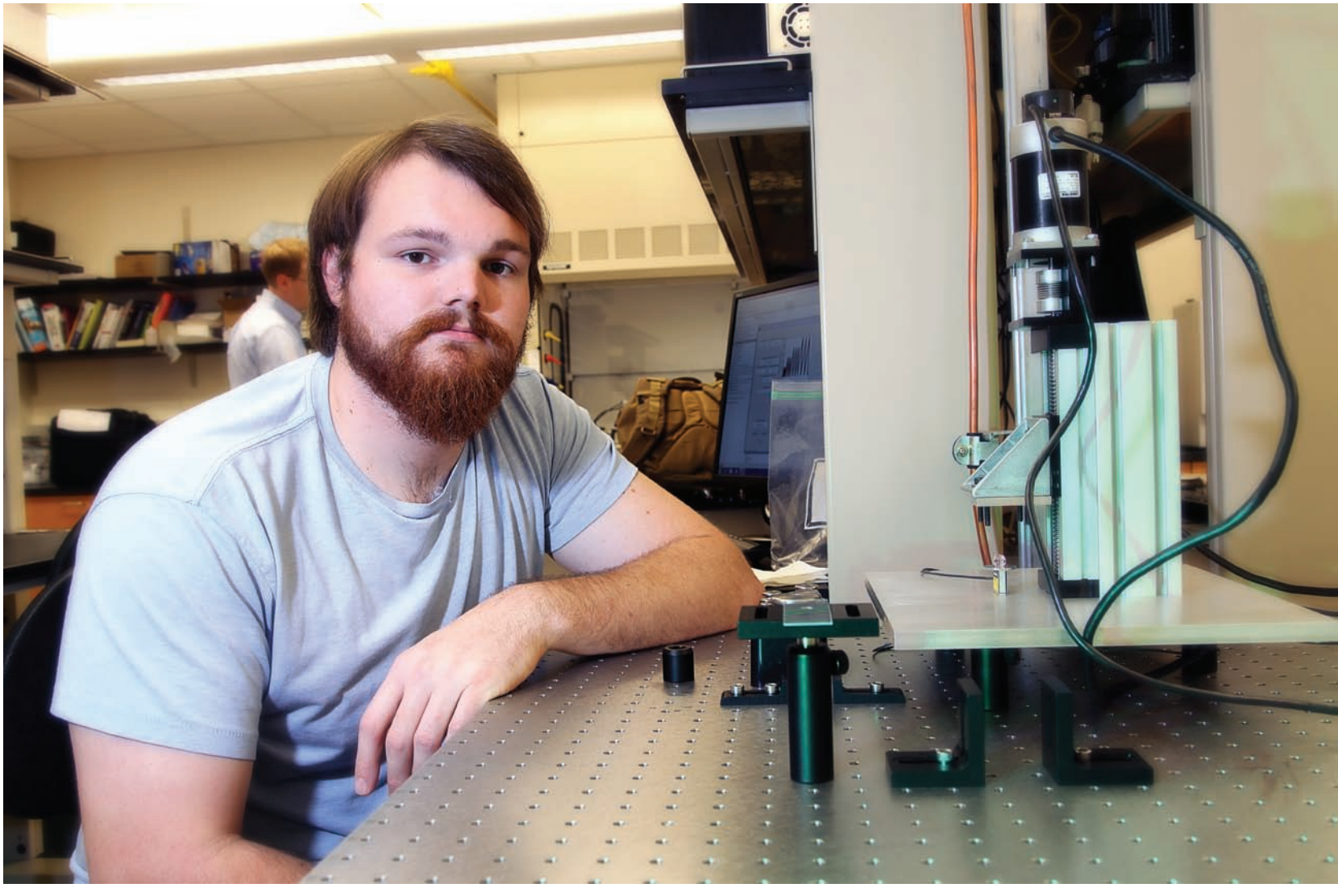
Perhaps an even greater reason for the undergraduate research program is to cultivate young minds. Through their close working relationships students form a bond with their mentors and have, in them, a person who can help shape their future.

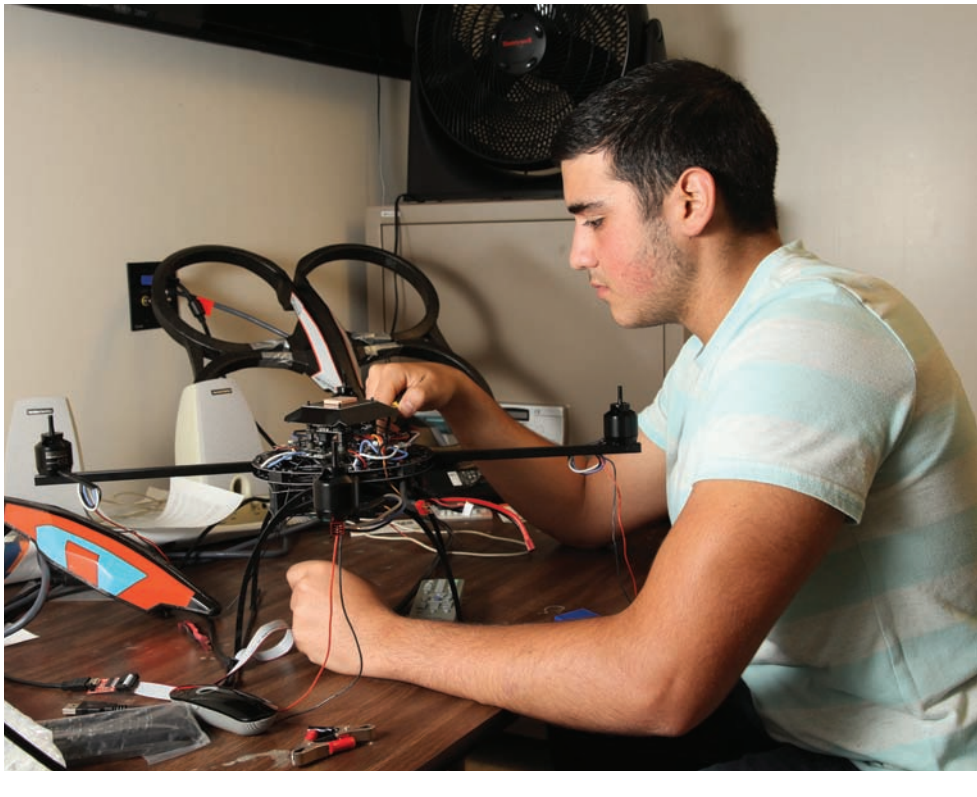
"I mentor Andrew because I started my research career as an undergraduate," Dr. Matthew Reilly explained. "My research mentors had a profound influence on my eventual decision to pursue a career in research."

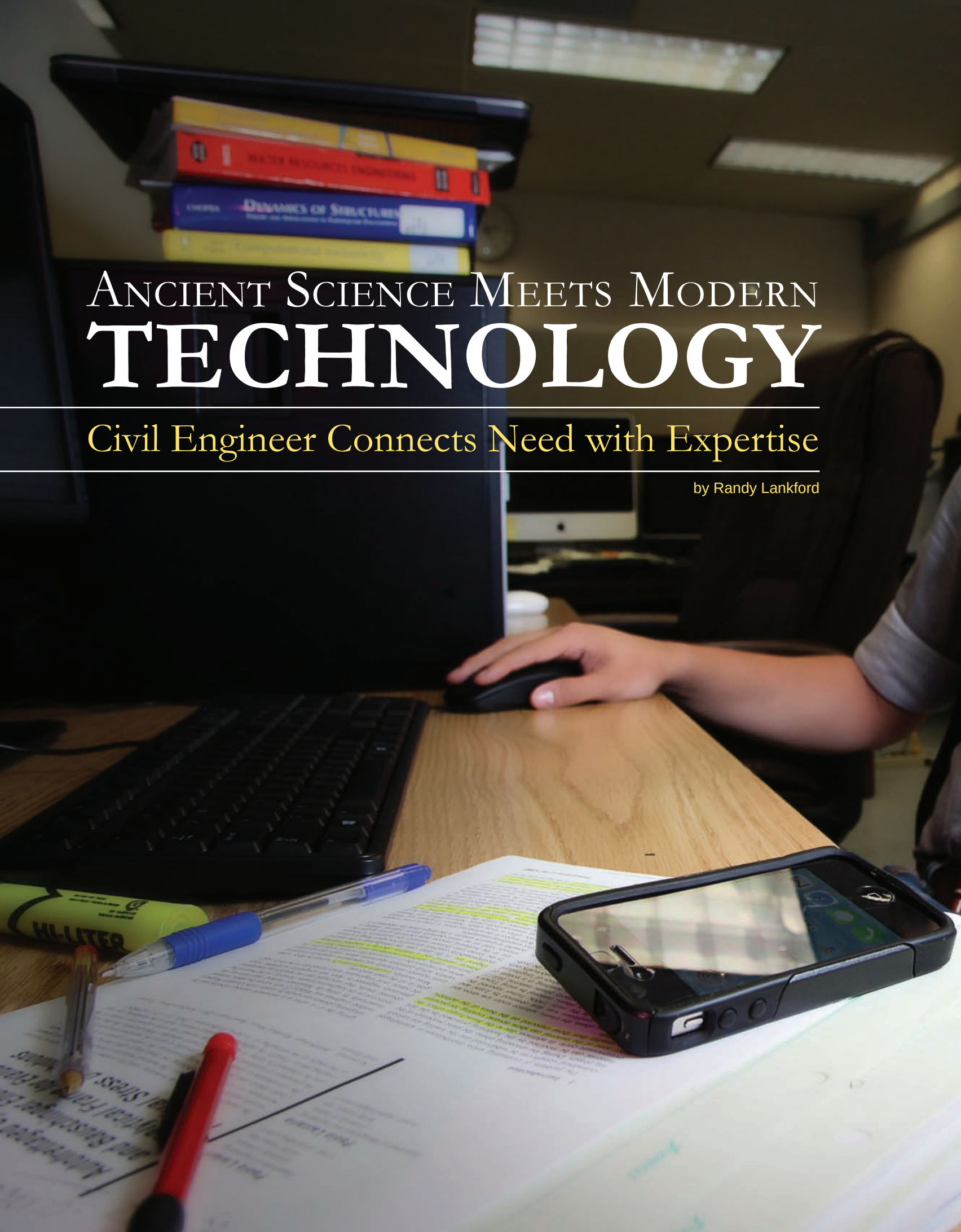
Regardless of the outcomes, the students who participate in the program can fulfill dreams without having to wait for graduate school.

"I have always been fascinated with robots and how they can communicate to operate in a more efficient way," said electrical engineering student Jonathan Lwowski. "This research enables me to satisfy my curiosity about unmanned systems and allows me to work towards my goal of getting my doctoral degree."









Ancient Science Meets Modern TECHNOLOGY

Civil Engineer Connects Need with Expertise

by Randy Lankford

When an ancient science, like civil engineering, meets modern technology, like smartphones, there are going to be stress points.

Structural engineers hate those.

Armando Gomez-Farias, who will earn his bachelor's degree in civil engineering in December 2013, and already has a smartphone, thought there had to be a way to use one to facilitate the other. Since bridges and buildings can't be moved to the lab for structural integrity analyses, it seemed logical to Gomez-Farias to bring the lab to them.

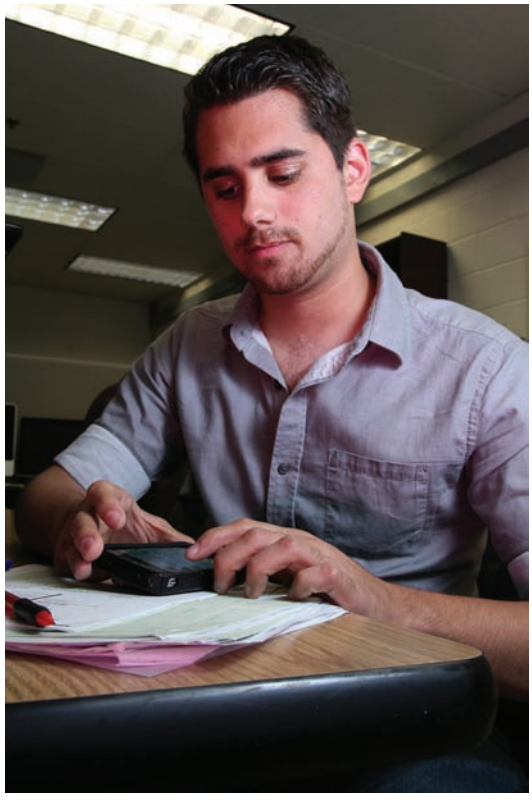
"Smartphones, using mobile apps, have the potential to solve problems in the field and on the spur of the moment," he says. "The convenient access to the output mobile applications often means the designer spends more time focusing on providing efficient and creative solutions rather than performing structural analysis and design calculations."

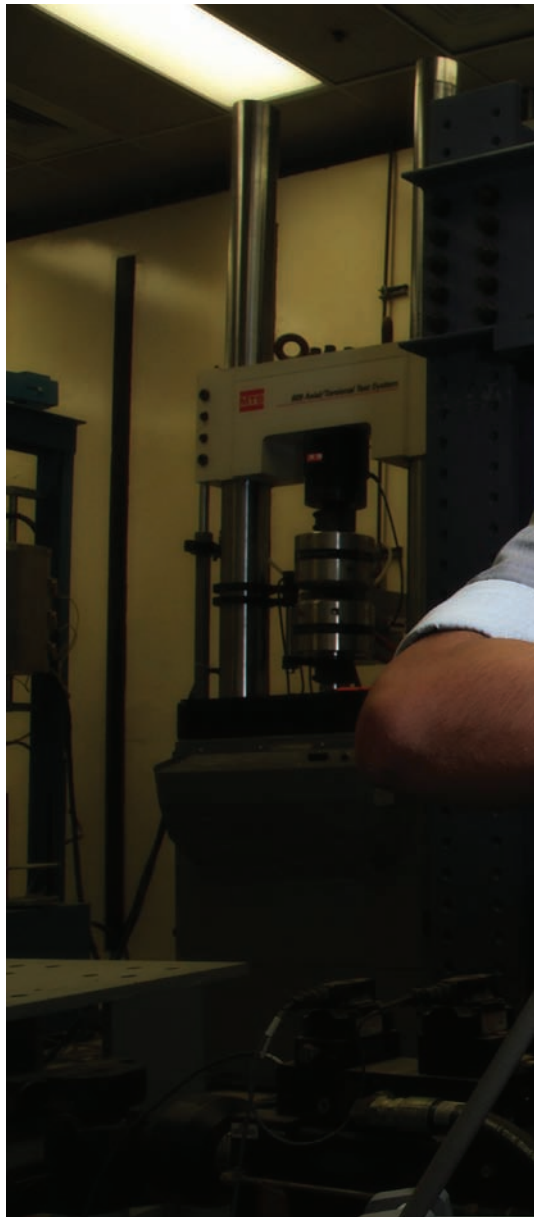
The only flaw in Gomez-Farias' thinking is that no such app exists. And, while it's a good idea, he's in the wrong field. He's a civil engineer, not a computer engineer. Fortunately, he's at the right university and doesn't mind stretching himself.

In analyzing his research goals Gomez-Farias realized he had two objectives instead of just one. He wanted to learn sensitivity analysis in order to identify critical material parameters, and no less importantly, he wanted to create a mobile app to determine whether a non-computer engineer could do such complex programming. That marriage of two engineering disciplines was the heart of his research project with Dr. Arturo Montoya and his thesis work with Dr. Manual Diaz.

"It is extremely rare for an undergraduate student to do the kind of research I am doing. I am grateful to the university and Dr. (Arturo) Montoya and Dr. (Harry) Millwater for this opportunity. Even graduate students aren't often allowed to do the type of research I am conducting. It is a big deal for the university to extend this level of trust to its undergraduate students and it is critically important for my future career that I am afforded these kinds of opportunities at UTSA."

"I asked Armando to join my research team after evaluating his performance in my graduate finite element class," Montoya said. "Armando was the student with the highest score in my graduate class as an undergraduate. I let Armando know that doing research will enrich his undergraduate experience and have him acquire unique skills. Classes introduce students to the basic material they need to know to work on their field, but research helps them master the





concepts as undergraduates. It also teaches students to work on their own and have high level discussions with faculty members."

The program Gomez-Farias is creating will have to meet some exacting standards. It will be written to satisfy the American Concrete Institute (ACI) Building Code Requirements for Structural Concrete (ACI 318-11), the American Society of Civil Engineers (ASCE) Standard 7-10, Minimum Design Loads for Buildings and Other Structures (ASCE 7), and according to the Strength Design or Load and Resistance Factor Design (LRFD) method.

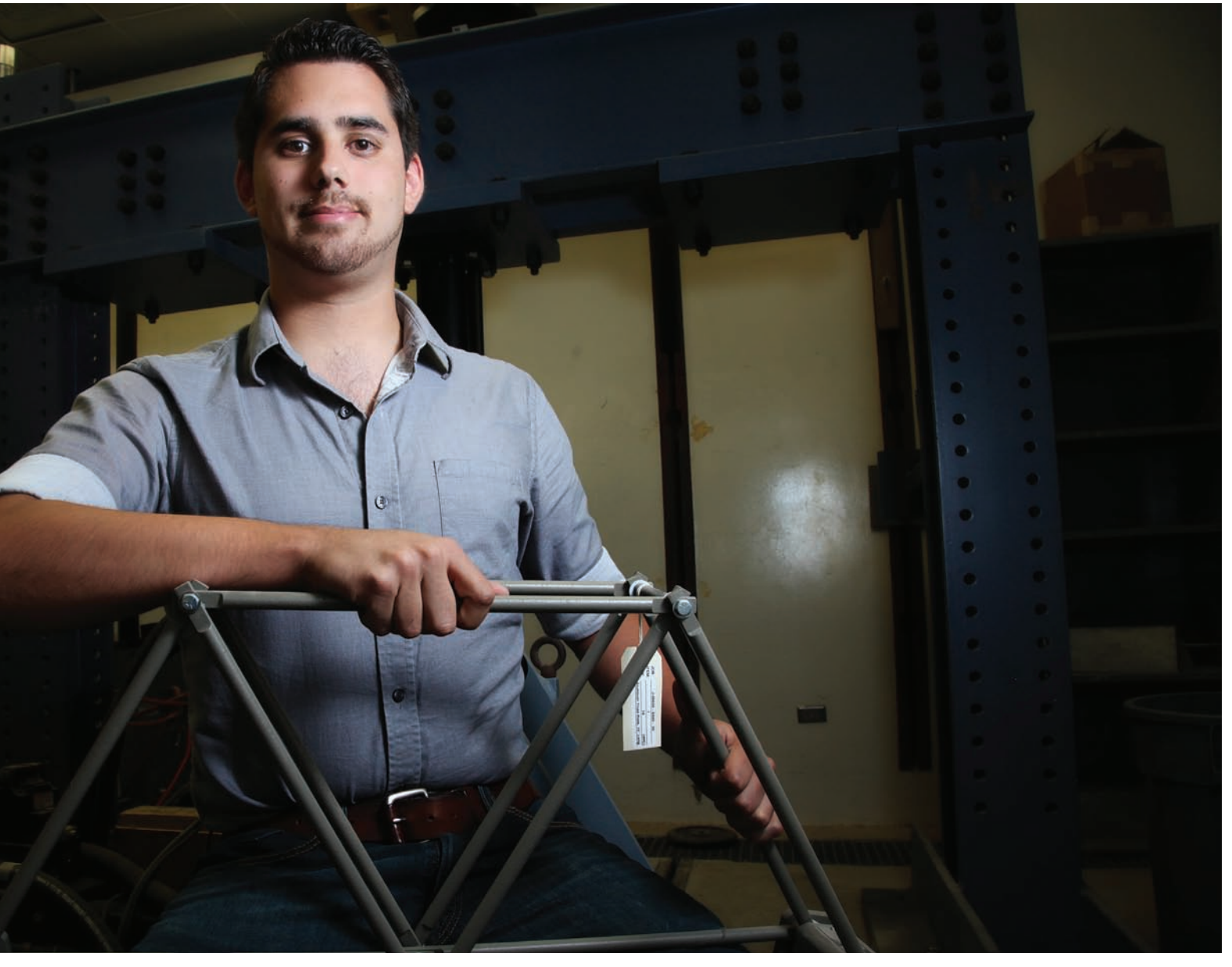
"My goal is to guide the user through the analysis and design process in a straight-forward and user-friendly manner," he explains.

"The program will be first written and developed using MATLAB software. Once the code has been tested and proven to be working appropriately, it will be translated into C-Objective in order to implement it into a mobile application suited for iOS devices. To accomplish this, the mobile app will be programmed using XCode, a Mac OSX Integrated Development Environment (IDE) that contains a suite of software development tools for iOS applications. Finally, the app will be tested using Xcode simulator. The tests will consist in typical case scenarios encountered in the field by structural engineers."

Gomez-Farias will enter grad school in the spring and intends to pursue a Ph.D. "I am interested in the development of structural analysis and design software and new materials that could revolutionize the structural engineering field.

"I want to be a very successful Mexican-American Master of Civil Engineering who can help society by providing safe roads, bridges and buildings. Obstacles, however challenging, can always be overcome. Attending UTSA has played a critical role in enabling me to reach my career and personal goals."

Gomez-Farias considers his current research his crowning achievement. "It is something new and it has significant implications in the world of engineering. The research being conducted here has world-wide practical implications."



DREAM BIG

Mechanical Engineering Undergrad Knows No Limits

by Randy Lankford

Kayla Lovelady isn't about to put herself in a box. But if she were, it would be a really good box. She would most likely design it with the same Abaqus software she's using to research the finite element formulation and analysis of anisotropic materials, and derive and implement the linear elastic finite element methods with an anisotropic constitutive matrix.

Why would she use such complicated methods to design a box? Because she can, and because of the training she is receiving under the guidance of Dr. (Harry) Millwater, Department Chair of Mechanical Engineering.

"I work with finite element analysis and am expanding the research on the complex variable Taylor series (CTSE) method, that Dr. Millwater and his lab developed. Essentially, I am testing the stresses, strains, and various sensitivities of certain models, such as cantilever steel beams, by programming a user element implementing the CTSE method to see if it will give more precise measurements in regards to stresses and failures," Lovelady said.

But the research Lovelady is doing is only one of her interests. As she prepares for graduation in December, she's considering a stint in the Navy to explore its nuclear program before going on to graduate school.

"My grandparents were in the military and my father was a police officer for 30 years and they instilled in me, this desire to serve," explained Lovelady. "The Navy has one of the best nuclear programs in the country and being part of that appeals to me. I would be able to use my degree for a greater good."

The 22-year-old San Antonio native is carrying on another family tradition as well. She'll join her father and sister as UTSA graduates when she receives her bachelor's degree in mechanical engineering. But tradition was only part of Lovelady's decision to come to her hometown university.

"UTSA is a big campus but it has a 'small school' feel. And since the engineering program is smaller than some other schools, undergraduates have a lot more opportunities to get involved in research, and that was something I was very interested in."

Prior to working with Millwater, Lovelady got her first taste of undergraduate research in the biomedical engineering department. "I was an undergraduate research assistant in the cell and tissue engineering lab," she said. "I was paired up with a Ph.D. and a master's student and began doing basic lab work."

The research involved testing the stability and structure of 3-D matrixes containing live cells. "I was doing actual cell culture work," Lovelady said. She and her partners tested the stability and structure of the matrixes to see what kind of pressures they could withstand and how the cells would react with the applied pressures.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"Then we took 3-D micrograph pictures, which generate images from multiple slices of the matrix. We tested the viscous properties of the collagen by applying different stresses at different rates. There were potential applications in wound care and cell growth." And even though the biomedical work was fascinating, Lovelady was looking for opportunities in mechanical engineering.

"After a year in that laboratory I decided to explore my options. That's when I met Dr. Millwater."

Millwater's description of the work his students were doing, particularly in finite element analysis and structure mechanics, was enough to hook Lovelady.

"It's awesome that I've been able to work in labs in two different engineering disciplines. UTSA allowed me to work in two completely different lab settings and to explore what I want to do with my future. Other schools just don't give undergraduates those kinds of opportunities.

"I would have never been able to do something like this if I went to a school where I was confined to a classroom. I'm able to work with graduate students and professors and see what they do and how they're involved in engineering. Undergraduate research expands your knowledge and skill set. It's important to apply the skills you learn in the classroom to real-life situations."

Lovelady, like other researchers, found her opportunities through flyers and professors actively recruiting undergraduates.

"The research being done here isn't solely the realm of Ph.D. and master's students. Undergrad research students are being paid for their work through monthly stipends, about the equivalent of a part-time job."

When things get too tense in the lab, she runs away from her problems—literally.

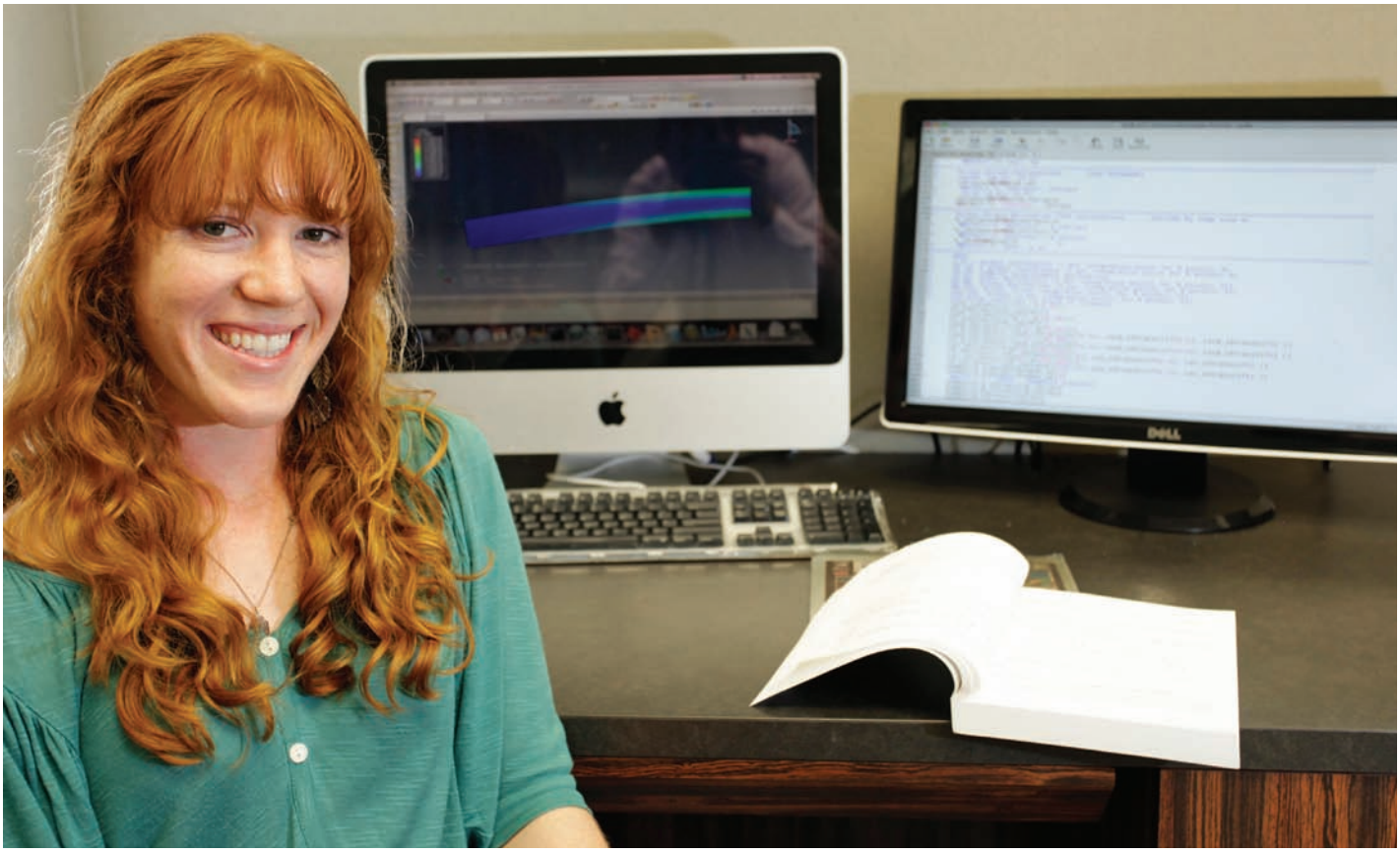
"I'm currently training for a half-marathon." Lovelady explained. "I want to strike a balance in my life. If I am going to work on complex equations that exercise me mentally, then I want to do something that is physically challenging as well. So, I jumped at the chance to run in a half marathon."

The only downside about her research work and training, said Lovelady, is having less time for other interests such as music.

"I originally wanted to go into music. It was a difficult choice. Music is a great hobby, and I still play now and then, but I wanted to do something different with my life so I chose engineering. Both require a tremendous commitment. You have to be willing to spend most of your time practicing and studying if you want to succeed. You really have to love what you're doing or you won't make it."

The redhead rankles at the idea music would be a more "traditional" career for a woman.

"I've never given much thought to the idea I'm a 'female engineer.' I just see myself as an engineer. There's really no difference between me and a male engineer. There's no reason that stereotype should persist. I have always had a strength and interest in math and science. It's always been something I've excelled in. There's nothing gender-related about that."



ENGINEERING BRILLIANCE

Thousands of Reasons

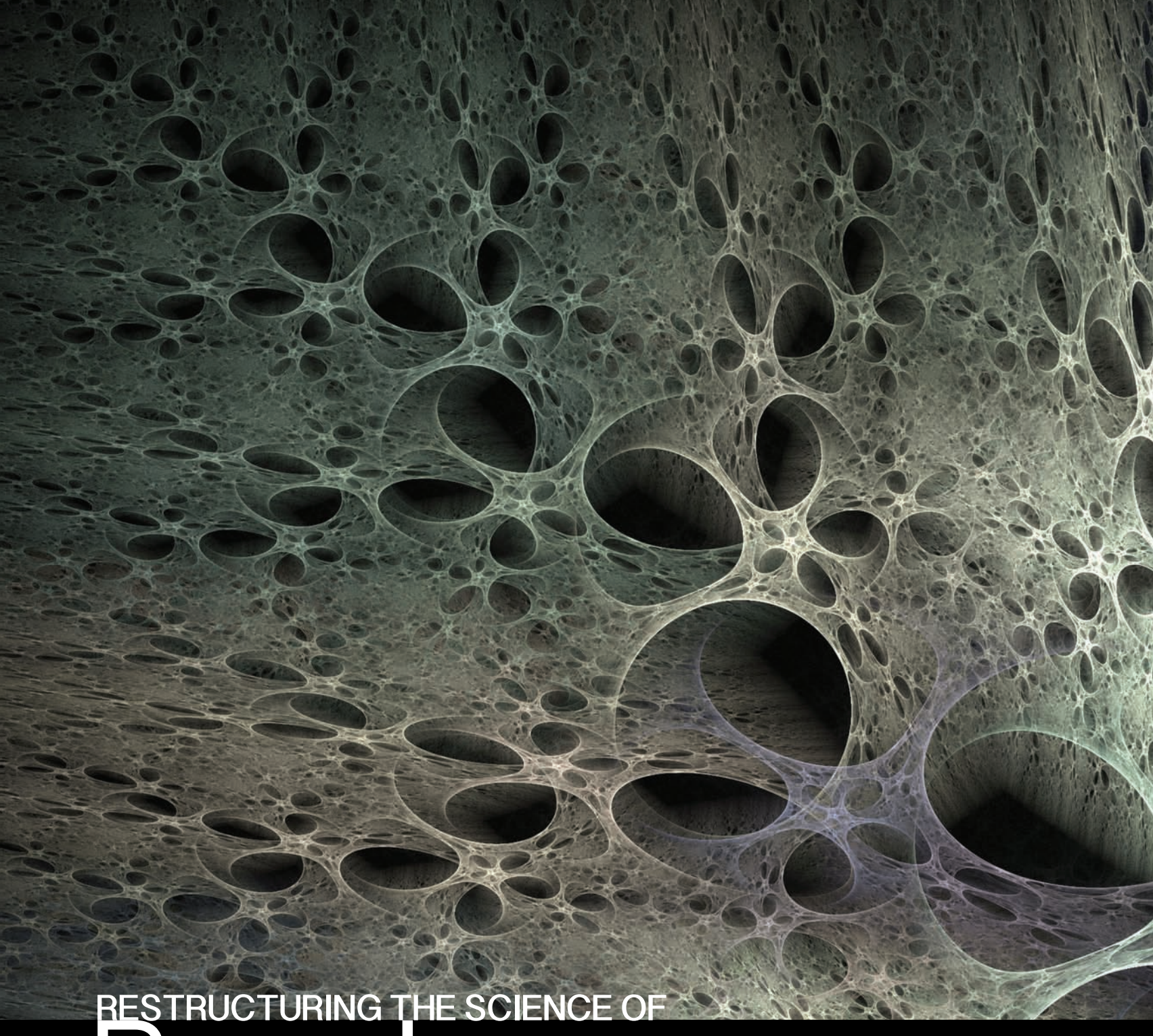
With more than 2,000 undergraduate and 400 graduate students in 17 degree programs, the College of Engineering is a driving force behind The University of Texas at San Antonio becoming a Tier One Institution. We are consistently voted one of the top colleges for Hispanic students. With small classrooms, professor interaction, and state-of-the-art facilities, students receive the best in education.

To help students take full advantage of everything offered in the College of Engineering, our goal is to provide scholarships and fellowships. If you need a reason to give, we've got thousands of them. To give to the College of Engineering, please visit https://giving.utsa.edu.

"I strongly believe that with our outstanding programs and rapid transformation, the University will be a Tier One institution and a globally renowned organization for its excellence in engineering research and education."

MEHDI SHADARAM, Ph.D.
Interim Dean, College of Engineering

UTSA Engineering



RESTRUCTURING THE SCIENCE OF

BONE LOSS

Casts, pins, screws, and even metal rods can help broken bones become whole again. But what happens when whole sections of bone are destroyed? What can doctors do in cases of severe combat trauma when there is just too little bone left to put it back together again?

Researchers at UTSA's College of Engineering are developing novel solutions to that problem. But it's not just the research that's exceptional; so are the researchers, including undergraduate engineering student—Marissa Wechsler.

Wechsler, a San Antonio native, joined UTSA in 2010 as a mechanical engineering major and a first-generation college student. Unlike most freshmen who spend their first semester adjusting to college life, Wechsler immediately began looking for research opportunities.

"Engineering is a difficult field and I wanted to be well prepared," Wechsler said. "For my freshman seminar course, I took Just-in-time math, which allowed me to get a head start on all the math classes I would

take in engineering. In that course, Brandy Alger was my mentor and she introduced me to UTSA's MBRS-RISE program (Minority Biomedical Research Support-Research Initiative for Scientific Enhancement)."

The MRBS programs are federally funded and increase the number of underrepresented faculty, students, and investigators who are performing research in the biomedical sciences. Even though Wechsler was a mechanical engineer, she knew her skills could be applied to the biomedical field, which is her true passion.

With little engineering experience under her belt, Wechsler was accepted as an undergrad researcher and her first tasks were learning laboratory protocols and techniques. With the guidance of Dr. Rena Bizios and some graduate students, Wechsler began work on her own project over the summer.

"My first real research project examined the effects of alternating electric current on the proliferation of human osteoblasts (the bone forming cells). I wanted to see how the alternating current affected the cells and if it caused more of them to grow. It turns out the current didn't change anything," Wechsler explained.

Even though the results of her initial experiments weren't what she'd expected, Wechsler was eager to continue her bone-engineering research. By the time her next semester began, UTSA had created a biomedical engineering program for undergraduates, allowing Wechsler to change majors while still working with Bizios.

Wechsler expanded her research beyond osteoblasts to examine the effects of alternating current on human mesenchymal stem cells. These adult stem cells form one of three types of cell: osteoblasts, chondrocytes (cartilage cells), and adipocytes (fat cells). Wechsler hoped the electric current could induce stem cell differentiation into the osteoblast phenotype.

"It is really interesting working with stem cells, because they can become a variety of cell types. For applications such as tissue regeneration, stem cell research is really the hot topic in biomedical engineering.

“I didn’t come into research wanting to work with a specific tissue type,” Wechsler went on to say. “I just knew I wanted to work with something on a cellular level or with tissue. Working with bone is interesting because we know that bones have regenerative capabilities. But if you are missing a section of bone, then the bone won’t regenerate, and it is important to figure out how we can fill that void.”

A custom-made laboratory set-up was used to expose the stem cells to alternating electric current for either three or six hours daily for up to 21 consecutive days. The current delivered to the cells varied in frequency and micro-amps during the course of the experiment. And unlike her initial research with osteoblasts, the results from her new experiment were promising. The results provided evidence that introducing alternating current into human mesenchymal cells, induces them to differentiate into osteoblasts based on their gene expression.

“The results of this research are looking good,” Wechsler explained. “Soon we might be able to re-grow sections of bone by using what our bodies naturally provide. If you’re missing a chunk of bone, for example, I can take your stem cells, push them into becoming bone cells, re-introduce them into your body, and hopefully regenerate the lost bone material. Can you imagine what that would mean for trauma victims?”

By allowing undergraduate students to conduct research, UTSA is paving the way for life-altering advancements. Not only does research lead to innovative ways for problem solving, but it also allows undergraduates to broaden their views on academia.

“I didn’t really know anything about getting a Ph.D.; conducting research as an undergrad really confirmed that I wanted to earn a higher degree. I think if undergrads plan on pursuing a higher degree it is important for them to do research. The training in the lab is completely different than what’s in the classroom. Also, you don’t need to be an A+ student to be a great researcher. Research experiences allow students to get a better understanding of themselves and what they enjoy, along with what they are good at.”

SIMULATING

VICTORY

Texans live and die by football. Friday nights are filled with packed high school stadiums, and Saturdays are reserved for college game day. Add the $422 billion yearly revenue of the sports industry, and you have something worth looking into. It didn't take long for students at UTSA to see the value in football—they just needed a kick in the right direction.

They're usually the smallest, least athletic players on the team and yet they determine the outcome of many games. They're the guys no one on the bench speaks to, the ones who only get into the game in desperate situations. They put the "foot" in football. Placekickers. When a team game comes down to an individual performance, especially one from a player who only gets into the game for a few seconds every week, it's an uncomfortable moment.

Placekickers only have one shot at scoring. When your teammates have exhausted themselves to put you in a position to win the game with one swing of your leg, you'd better make it count.

Kickers rely on endless repetition of a very specific series of motions to develop a routine they can trust when the game's on the line. In the last second, with the crowd screaming, the coaches pleading and the defense charging, they don't want to have to think about what they're doing. They want it to be automatic. But every kick is different; field position, wind direction, the pressure of the moment.

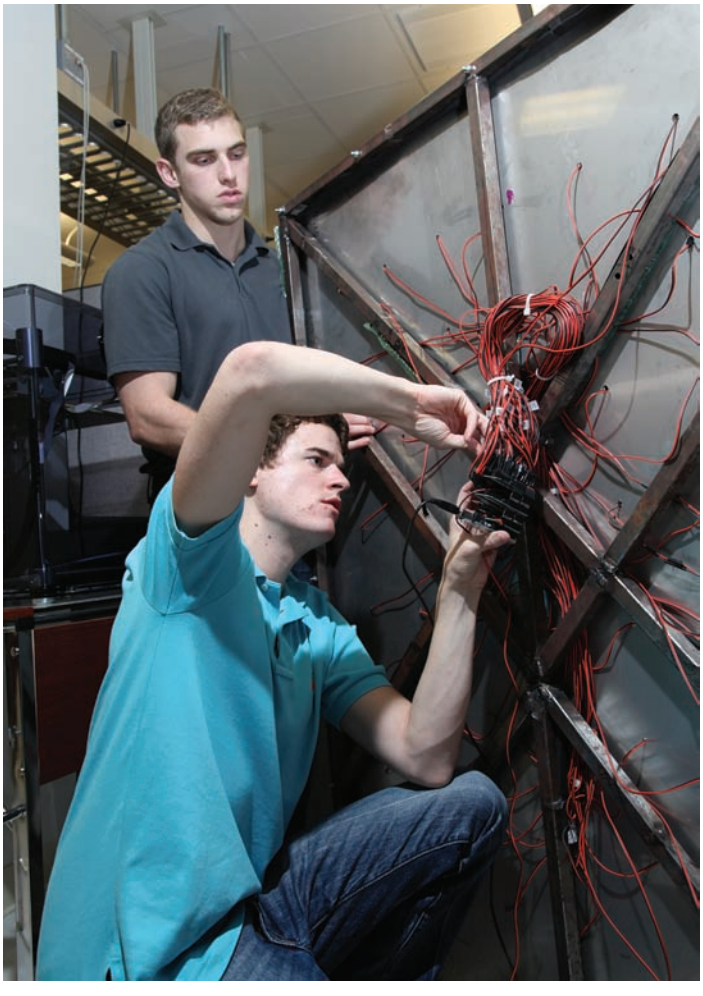
To improve the odds of making those kicks count, UTSA students, along with the Center for Visualization, Simulation and Real-Time Prediction (SiViRT), funded by a grant from the National Science Foundation (NSF), are teeing up a project to create a portable, accurate football kicking simulator.

The Football Kicking Simulation and Human Performance Assessment is a virtual training system that uses real-time wireless feedback and computer sensing to measure football kicking mechanics data. Comprised of multiple feedback platforms, a kicker can obtain valuable information about his stance, kick, trajectory and power. All of this can be done on the field or in a laboratory environment. The simulator is even designed to replicate the pressure of a real game-saving moment through realistic, 3-D stadium simulations.

UTSA mechanical engineering undergraduate students Alyssa Schaefbauer, Cole Meyers, Jacob Kantor and Michael Lasch, kinesiology undergraduate student Ekow Acquaah, along with electrical and computer engineering graduate student Aaron Stout and computer science graduate student Ehren Biglari, have been developing and testing the virtual training system under the mentorship of Dr. Yusheng Feng since February 2012.

The initial concept came about when Schaefbauer spoke to Feng about working on undergraduate research. Feng agreed to let her join the SiViRT team, provided she did well in his thermodynamics class. On the first test, Schaefbauer earned an A and began her life as a researcher.

"I came up with the design for the simulator after being approached by Dr. Feng about doing research into similar products," Schaefbauer said. "He had wanted some research done on kicking simulators, and I



took that and ran with it. I don't think he was expecting all of the data and information I came back with. From then on, I was more or less the student team leader."

From her initial results, Feng and Schaefbauer realized the potential of the project at hand. They also knew that more experience was necessary to fill out the team. As the team grew, it went beyond engineering and crossed over to complimentary disciplines like kinesiology.

"I wouldn't have expected to see how much our fields overlap especially in biomechanics," explained Acquaah of the mutual research. "I really love seeing the research from a quantitative state. In kinesiology, we study the concept behind the body and its movements, but working with engineers I can see the numbers behind all of it."

Once prototypes were created, the team needed a test subject. They reached out to the UTSA football department and enlisted the help of assistant coach Perry Eliano and star kicker Sean Ianno.

"The simulator is an awesome idea," said Ianno. "Although it is not a finished product yet, it has the potential to be on the cutting edge of technology and quite possibly could revolutionize how kickers train.

"The best feature of this simulator will be getting immediate results. Usually I would record myself on video and watch it later then wait until the next day to make corrections, but being able to make those corrections while they're fresh on my mind changes everything about training," added Ianno.

"The kicking simulator is an incredible project and something I believe can be very beneficial not only for our kickers, but for kickers across the country," Eliano said. "I'm really humbled and thankful that the College of Engineering and their students who worked their tails off on this project chose us to be a part of it."

Confident about their product, the research team has filed a patent application for the technology through the UTSA Office of Commercialization and Innovation and the team hopes to make the simulator commercially available for coaches and football teams to use as a training tool. The research team has also published two papers that were presented at the International Workshop on Computer Science in Sports and the Society for Modeling and Simulation International conference this summer.

The multidisciplinary approach, and the introduction of the simulator in a multibillion-dollar industry is a winning game plan. The research that began with the eagerness of an undergraduate wanting to get into a lab, has now evolved into a campus-wide project with unlimited potential.

"The football kicking simulator is a perfect example of how engineering and science can make improvements beyond the scientific arena, such as football, that are of interest to the greater community," said Feng.

Bioscience Evolves into Bioengineering

Multidisciplinary research at UTSA brings undergraduate students from the classroom into the engineering laboratories.

What do hydroxyapatite and mammalian bones have in common? Quite a lot actually, and it is through these common bonds that research students like Claudio Macias hope to regenerate new tissues and bones.

Macias, a double major in biology and mathematics, joined Dr. Anson Ong's biomedical engineering lab through the MARC U*STAR (Minority Access to Research Careers - Undergraduate Student Training for Academic Research) program at UTSA which focuses on a limited number of research topics, pertaining primarily to biomaterials, drug delivery mechanisms, and tissue engineering.

"My interest in regenerative medicine led me to get involved in this research," Macias explained. "I chose tissue engineering because I am fascinated with the idea of regenerating organs or perhaps even growing an organ in the laboratory.

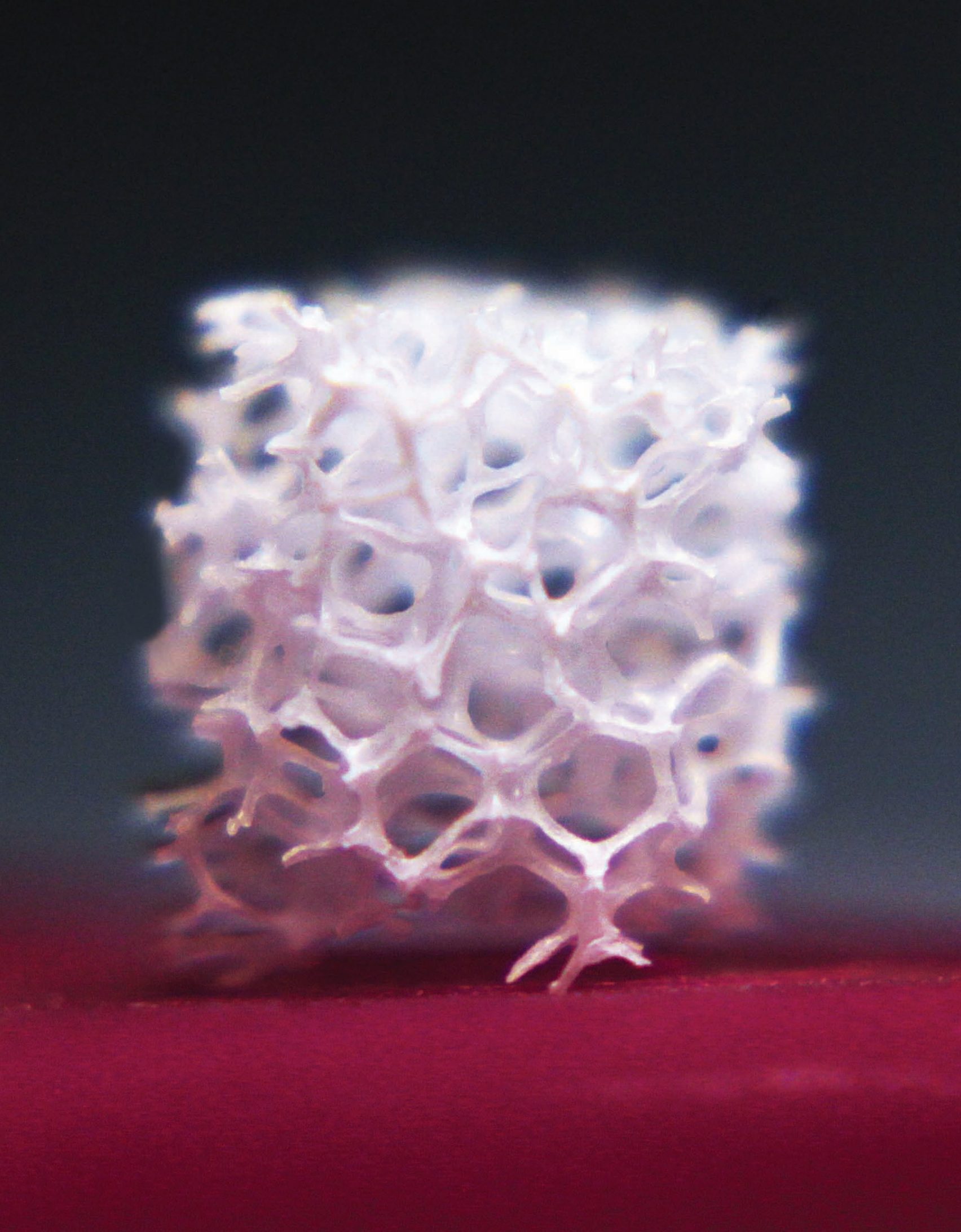
"One of my current projects deals with creating scaffolds of hydroxyapatite, a calcium phosphate mineral that is chemically similar to the biological apatite found in bone. This mineral will be coated with collagen, a structural protein naturally found in the extracellular matrix of tissues, to improve the biological activity of our scaffolds, and to give them a better ability to bear loads," he went on to say.

As research advances at UTSA, a growing number of students are spanning the boundaries between disciplines and majors. Biomedical engineers often work closely with mechanical engineers in the development of artificial limbs, so it is only natural that they also work with biology researchers. This multi-disciplinary approach to research not only advances the work being done in the labs, but it also provides students with new ways to view their own scientific paradigms.

"Like many other UTSA undergraduate students," Ong explained, "Claudio is setting a new trend by performing applied research in multidisciplinary programs like biomedical engineering (BME). These students understand that learning extends beyond the classroom environment. They benefit greatly from such research experiences because they are exposed to state-of-the-art technologies in research labs and the latest knowledge in the field of their interest. And many of these undergraduate students are augmenting their research experience through summer research programs beyond UTSA. In Claudio's case he does his research during the academic year in the BME lab at UTSA and his summer research at Johns Hopkins University School of Medicine and Massachusetts Institute of Technology.

"During my time here at UTSA, I've seen our undergraduate students become more inquisitive in their quest for new knowledge. This indicates a change in culture in the undergraduate student population toward research and learning, as well as a move for UTSA towards achieving Tier One status."

"I think it is very important for undergraduates to conduct research because it gives them an idea of what graduate school is like," added Macias. "In the lab, I can conduct my own experiments, go through problem solving and critical thinking processes, and really develop an understanding about what I am doing. When it comes to engineering, I like that fact that I can apply the basic knowledge of science to solve real-world problems. Engineers create a device and make sure it is functionally efficient. As a biologist, however, I can see how well the device works within the physiology of the intended recipient."



EXPLORATION ABROAD

Photos by Christian Trevino and Raquel De La Garza

Raquel De La Garza and Christian Trevino, Honors College and engineering students, study abroad in Urbino, Italy where they pickup the language, the culture, and a renewed appreciation for travel.

Approximately an hour from the Adriatic coast and three-and-a-half hours northeast of Rome, sits the picturesque, walled city of Urbino, Italy. Urbino rests on a hill, above the Italian countryside, looking much the same as it did during the Renaissance—if one can ignore the car parks marring the scenery. The city, home to famous artist Raphael, was the destination of choice for two engineering students who spent a semester studying abroad.

Raquel De La Garza and Christian Treviño, both mechanical engineering majors, went to Italy as part of a UTSA study abroad program designed to get students out of their comfort zones and into new environments.

The University Carlo Bo, of Urbino, the highlight of the trip for De La Garza, dates back to 1506. Designed by Giancarlo De Carlo, much of the architecture and buildings were preserved and kept in the same condition as they were in during the Renaissance. The stylized construction and ambiance gave an old-world feel to modern education standards.

"I was amazed by how they preserved this incredible structure," said De La Garza. "Every window, balcony and door showed beautiful views, and the craftsmanship is perfectly illustrated by the fact that the building looks good, even after all these years."

Like most people, engineers are multifaceted. It's not all about math and fluid dynamics. The nonengineering-related material encouraged the students to see the world in a different light. According to Treviño, it gave them a chance to see how engineering could work in previously unthought of ways.

"Spending time away from my structured path of engineering, here at UTSA, allowed me the freedom to imagine, 'What do I want to do with a degree in mechanical engineering?' It gave me such a fresh outlook on engineering in general and how it is really handled in other parts of the world."

"During this trip I viewed everything with an engineering approach even though I was not there as an engineer," added De La Garza. "The Coliseum, the Pisa Tower, the arena at Verona, The Ponte Veccio, every single one of them is an amazing structure to study as an engineer."

Qualifying for the program isn't easy. Participants must be enrolled full-time (12-15 credit hours for undergraduates and 9-12 credit hours for grad students) and maintain a defined GPA (2.5 for undergrads, 3.0 for graduates) to qualify for the study abroad program. The participants were given opportunities to study a variety of topics from Italian history to journalism throughout the semester. The academic guidelines and courses are established to ensure students get the most out of studying abroad.

"I was part of a program for the College of Liberal and Fine Arts while I was abroad," explained De La Garza. "Some of the classes offered during that time were Italian language, history, arts, cinema, and journalism. Since I will be getting a minor in Italian, when I am done with my Advanced Italian class this December, more opportunities will be created to work in countries outside of the United States. Overall, this experience to learn first-hand the history and language of Italy was priceless."

Echoing her sentiment, Treviño said, "I learned to be Italian. I learned to drink, eat, dress, walk and talk like an Italian. I learned to live easy and

free, to love, and I learned the importance of living with pure passion. I feel so incredibly inspired to chase all of my dreams, no matter how crazy they are."

Like all good study abroad programs, the one to Urbino encouraged the students to visit places outside of the city. With such a diverse culture and landscape, the students were eager to see what else Italy and Europe had to offer.

"While in Venice, I was able to catch the pre-celebrations and first day of Carnevale," recalled Treviño. " I made a weekend trip down to Naples and was there to witness the chaos of the presidential elections in southern Italy. During our spring break we were even lucky enough to catch a Futbol Club Barcelona game at their home stadium. While in Rome, we stayed near the Vatican and walked with thousands to catch a glimpse of the new 'Papa' as he made his first address to Italy and the world."

Whether they were studying Italian, mentally deconstructing ancient engineering, or traveling the countryside, De La Garza and Treviño acknowledge the trip to Urbino will have a life-long impact.

"The funny thing is that the experience is still ongoing for me. I was lucky enough to study and travel with some of the best individuals I have ever met," explained Treviño. "The bonds that grew while living with these newfound friends are so incredibly strong. I love every single moment that I shared with them there and the ones we have shared since. Because of them I have the best memories. The places were beautiful, but they are amazing."

SPOT LIGHT

Brandy Alger

"There is one basic principle that I look for in any job— If you love what you do and have the people behind you, then there is so much area and energy to succeed."

What made you come to UTSA?

I wanted to get away from North Texas and started looking at other schools in Texas, which led me to San Antonio. I saw that UTSA had a great engineering program as well as a fantastic student life with multi-faceted resources.

There are so many things to do all the time that I always had something going on. Joining the Society of Women Engineers (SWE) as a freshman was a great choice because I was able to get a lot of mentorship from upper classmen as well as connections and networking opportunities that put me where I am today.

What degrees do you have from UTSA?

I have a bachelor of science and master of science degree in Electrical Engineering.

What do you do in the College of Engineering?

I am now the Assistant Director for Engineering Outreach. I recruit high school students for UTSA Engineering, talk to schools and communities about STEM, coordinate and run the COE Summer Camp and Engineering Living Learning Community (the on-campus engineering residence hall), put on seminars and tutoring services for current students, help students with questions about scholarships, internships, student life and pretty much everything else, mentor the 21 engineering student organizations, coordinate and run the STEM fest, and finally I make everybody's day better (kidding, not kidding.)

Why did you stay after earning your degrees?

Every year I changed my idea of what I wanted to do after college. When I started I wanted to work on circuits, my sophomore year I wanted to do biomedical engineering research to help disabled people feel, see, hear, etc, my junior year was all about energy and helping third world countries with sustainability and renewable resources, my senior year I was sure that I wanted to do Teach For America (which I got to the final round of interviews) and my super senior year was devoted to making engineering education matter in the U.S. and how to get more minorities and women engaged in STEM.

Everything that I wanted to do had something in common; helping people and changing the world. Through the improvement of STEM education as well as motivating more women and minorities to pursue STEM careers, I could make the world a better place.

What is your favorite part of your job?

I love working with engineering students, I love helping them reach their goals, and I love helping high school students realize their potential in a technological predisposed society. I would do anything for our students, which is how I realized my real passion for STEM education.

I also really love the role models and mentors that I have had the pleasure of having in my life, who are all directly tied to the College of Engineering. I get really excited about coming into work and knowing that what I do makes a difference and that I have people who believe that too.

BRUTESQUAD

Who throws the best tailgating parties? The BruteSquad! But who are they, and what do they do?

They are a group of UTSA College of Engineering (COE) advisory council members, and others, interested in improving the student experience at UTSA, while having a ton of fun. To do that, the BruteSquad has the best tailgating parties before each UTSA football game and is ready to prove that UTSA engineers have the most fun.

Each game, the BruteSquad likes to showcase the work of different student organizations from the College of Engineering, like the race cars, concrete canoes, or winners of the COE catapult competition. The tailgating party is located in a great location near Sunset Station and any students wearing College of Engineering shirts can attend for free.

Last football season, their goal wasn't just to have fun but also to raise money for engineering and student groups. The BruteSquad raised more than $18,500 and donated the funds to the various UTSA Engineering and Spirit groups.

"BruteSquad at its core is about supporting the UTSA engineering program and building the overall student experience. We showcase a different engineering student group each week, but all engineers are welcome. All we ask is they wear their UTSA Engineering T-shirts to get in. Come aim to prove engineers at UTSA really do have the most fun," said David Spencer, President, Texas Intrepid Ventures.

Photos by Matthew Pompa

BRUTESQUAD SPONSORS

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Engaging Community Outreach

The UTSA College of Engineering takes STEM to the streets. Through outreach and community events, the college introduces STEM topics to San Antonio's youth.

What do science experiments, robots, and pumpkin-hurling trebuchets have in common? UTSA Engineering. The annual Monster Mash Pumpkin Smash, Interactive Technology Experience Center's (iTEC) summer and spring break camps, engineering summer camps, and the Getting Excited About Robotics (GEAR) and For Inspiration and Recognition of Science and Technology (FIRST) robotic competitions are all part of the College of Engineering's outreach programs.

In order to expand science, technology, engineering and math (STEM) awareness, the college is reaching out to the community by creating interactive programs that help excite students about and prepare them for STEM-related fields.

"UTSA's College of Engineering offers such a rich selection of hands-on engineering events and programs, which allow visitors to experience STEM in an inviting and exciting light," said Brandy Alger, assistant director for Engineering Outreach. "STEM interest is very low in the nation, especially for minorities and women; consequently, we are in a losing battle for the passion and interest of a crucial component of the community that may have a front row seat in changing the world. That being said, by allowing students to experience these programs first-hand we can change the point-of-view of minority youth about STEM and ultimately change the future for these students."

Each year, iTEC offers San Antonio area kindergarteners through 12th graders a week long spring break camp and several week long summer camps featuring topics like exploring robotics, microbiology, human biology, geology, science, food chemistry, aviation, weather, forensics, biomedical and even rollercoasters. Participation in the camps has skyrocketed from 100 in 2009 to nearly 1,000 in 2013.

"Students are given the opportunity to experience STEM curriculum while utilizing several different education platforms," Roberta Bauer, program coordinator said. "The unique iTEC experience challenges students in several major scientific fields through customized lesson plans.

"Our lesson plans encourage young scientists to excel in advanced problem solving situations that require efficient use of time, energy and teamwork. The sense of accomplishment and confidence fostered by the iTEC experience has the potential to elevate students' understanding of the world around them through the scope of science and technology," she added.

Although iTEC's primary focus is on younger age groups (kindergarten through eighth grade), the College of Engineering offers a series of week-long overnight camps, featuring more advanced science and engineering experiences, along with age-appropriate recreational opportunities for high school juniors and seniors.

"I loved this camp," said Carmelo Alcorta, a high school student who participated in one of the summer camps. "I have learned so much from everyone I can't wait to start going to college to major in mechanical engineering."

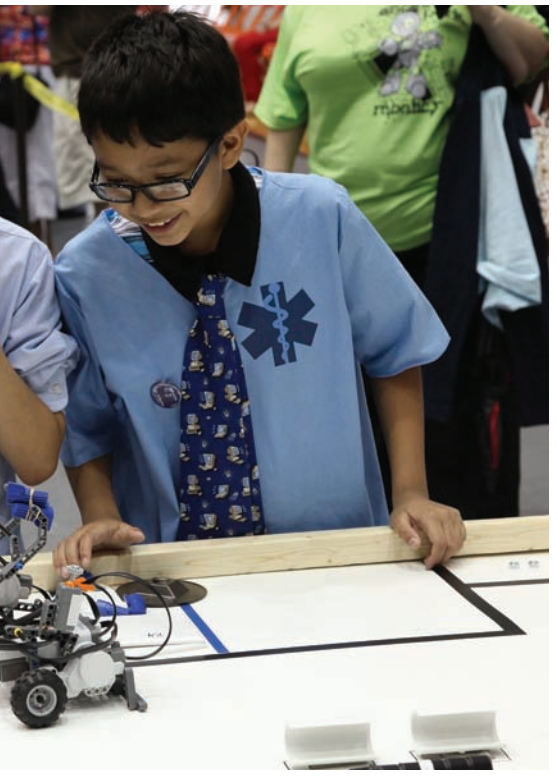
Aside from camps, the college also supports a number of robotics competitions for various age groups. iTEC and the college host the annual G.E.A.R. competition in which elementary and middle school teams design robots that navigate through a series of obstacles. The competition not only awards teams that complete the obstacles with the highest scores, but also gives trophies for things like overall best design, best team uniform, and unique problem solving. G.E.A.R. encourages both STEM-related learning and fundamentals such as teamwork.

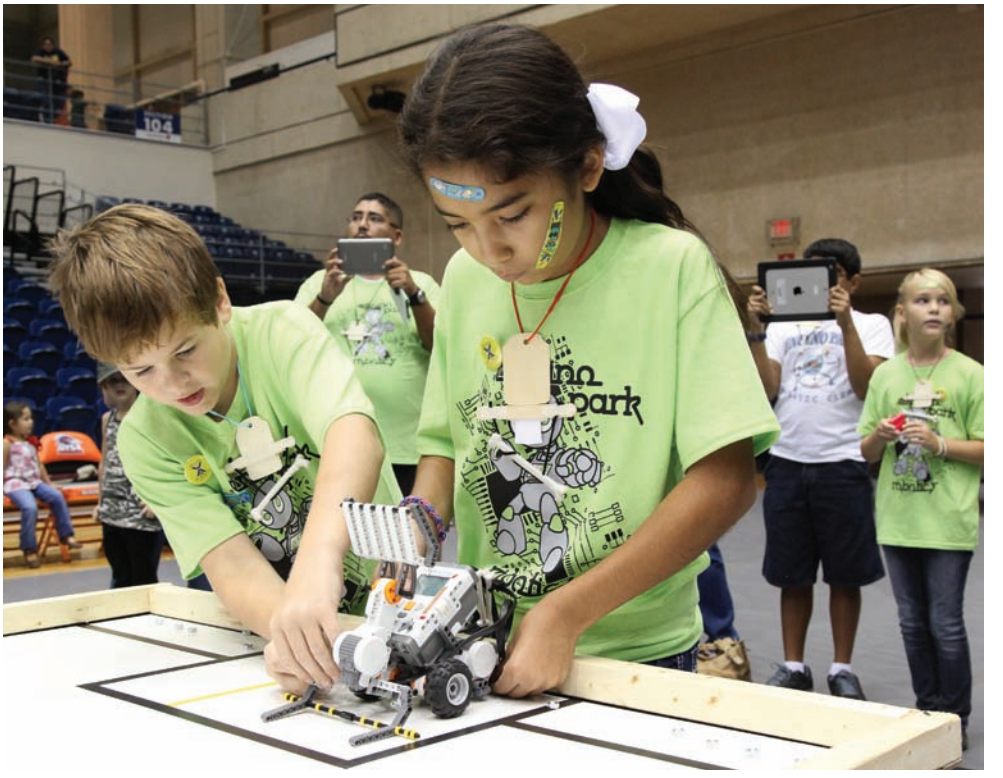
For high schoolers, the college coordinates the Alamo Region FIRST kick-off and attends the competition, hosting a booth describing UTSA Engineering. Accomplished inventor Dean Kamen, founded FIRST in 1989 to inspire an appreciation of science and technology in young people. The FIRST Robotics Competition (FRC®) is an annual competition that challenges high-school students—working alongside professional mentors—to build and program their own robots which they then pit against a field of competitors in order to experience the excitement of science, engineering, technology and innovation.

The student council and student organizations within the college also actively participate in outreach. They provide mentorship and classroom visits to various San Antonio schools. Students also host the Monster Mash Pumpkin Smash STEM Fest which challenges students of all majors to design and build a medieval trebuchet that will launch and destroy a pumpkin. The current distance record is more than 700 feet.

In addition to slinging pumpkins, the festival includes engaging hands-on science experiments for the kids, a costume contest, virtual-reality roller coaster, moon bounce, dunk tank and other family-friendly activities.

Through partnerships with local schools and industry, The College of Engineering brings STEM activities to the community at large providing many students their first hands-on experiences in STEM topics.






UTSA Engineering

Q&A on LID

"Green engineering is becoming more applicable in unified development codes in larger cities. This acceptance will bring more design innovation in the engineering industry. I want our students to graduate from UTSA's engineering program with a competitive edge, literally thinking outside the drainage box."—Dr. Afamia Elnakat

An open discussion with Dr. Afamia Elnakat: How her passion for Low Impact Development is changing UTSA for the better.

What is LID?

LID stands for Low Impact Development, Low Impact Urban Design, or Low Impact Design. The objective of LID is to use "ecological engineering" to manage storm water runoff. The main goal of LID is to mimic predevelopment hydrology and try to keep the stormwater using green infrastructure vs. conventional design that requires piping, concrete infrastructure, and manages the water off site.

Why is LID important?

With the increase in population and development, in terms of housing, roadways, and commercial infrastructure, there is an increase in impervious cover, like nonporous concrete. Coupled with hard, parched top soils, optimal conditions for increased water run-off and flooding are created. Storm water is not only a concern due to flooding (quantity), but also pollution (quality) due to increased pollutant loads carried with the storm water.

How did you get involved in LID?

LID is viewed as a pioneer field even though these best management practices have existed for many years. LID is becoming more popular as a design method with engineering consultants. I was first introduced to the concept during my tenure at Pape Dawson Engineers working on Edwards Aquifer permits for development. Here in San Antonio, we utilize some LID best management practices to reduce the impact of impervious cover on our recharge areas. On the UTSA 1604 campus, for example, we have a sedimentation filtration basin, curb cuts, pervious pavers, and vegetative filter strips as part of our Edward's Aquifer protection measures.

What are the advantages & disadvantages of LID?

ADVANTAGES:

- Reduce infrastructure cost.
- Eventually LID landscaping can mature to equal market costs for an enhanced ecological look.
- Extend lifetime of existing infrastructure.
- Alleviate environmental impacts.
- Reduce impervious cover.

DISADVANTAGES:

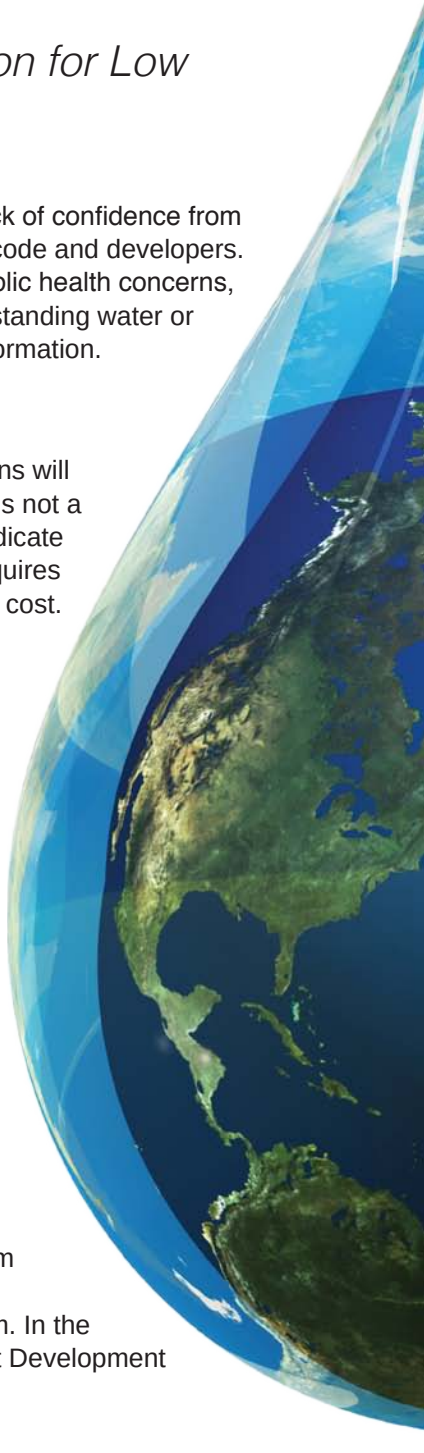
- Many LID design concepts restricted are by zoning & development codes.
- Minimum street width might not work for buses, emergency vehicles, and other utility vehicles.
- Lack of confidence from city code and developers.
- Public health concerns, like standing water or ice formation.

An important note is that LID designs will also require maintenance, but this is not a disadvantage since many critics indicate conventional infrastructure also requires maintenance, but at a much higher cost.

Why is LID important to UTSA?

It is important that our students be familiar with reducing the impact measures of their own designs. With more stringent regulations, environmental impacts will dictate many of the actions required to make an engineering design successful and implementable. I'm hoping that our students will lead that front given the many great opportunities for ecological design that exist here in the Hill Country.

To help prepare our students, Department Chair for Civil and Environmental Engineering, Dr. Tom Papagiannakis, has diversified our environmental engineering program. In the fall of 2014, I will teach Low Impact Development and Urban Design (CE 4953).



Inaugural Water Symposium

"The importance of the issue cannot be overstated given the vital role of water in the future growth and prosperity of the San Antonio metropolitan area."—Tom Papagiannakis

by KC Gonzalez

The Water Institute of Texas (WIT) brought local, state and national experts to the UTSA Downtown Campus on October 4, 2013, for a daylong symposium to share insight into Texas' primary water issues: long-term water availability and water regulation. Seventy-five people attended the first public event hosted by WIT since it was launched in 2012.

According to Tom Papagiannakis, WIT interim director and Robert F. McDermontt Professor and Chair of the UTSA Department of Civil and Environmental Engineering, "We have brought in experts from across the country to discuss the state of the art in water science and how to apply these principles in everyday life. New technology can predict floods and give us an overview of how to control our water. Technology is very important in helping us determine how much water we have and how to better manage it. Technology can give us solutions."

The symposium stimulated a frank discussion on how existing water supplies can be combined with the available water harvesting and transporting options in San Antonio and the surrounding region. To satisfy future water needs in this area, topics of discussion included projected population increases, as well as the anticipated changes in industrial activity (including power generation) and agricultural use.

UTSA environmental science doctoral student Sepehr Rezaeimalek said, "As a Ph.D. student, I am going to work on numerical simulations and see how some of these well-known people are doing their simulations. Their approach was quite impressive. Overall, in a nutshell, I found the presentations very helpful and useful."

Mauli Agrawal, interim UTSA vice president for research, welcomed the audience and Kevin Wolff, Bexar County commissioner, set the stage. "San Antonio and Bexar County lead the way in water conservation for the state, if not the nation. In fact, over the last 20 years, San Antonio has doubled in size and yet we consume the same amount of water we did 20 years ago. So that tells you that over time, we've been able to institute a culture of conservation."

Soroosh Sorooshian, director of the Center for Hydrometeorology and Remote Sensing and Distinguished Professor of Civil and Environmental Engineering and Earth System Science at the University of California, Irvine, provided the keynote presentation on long-term water availability. Other experts, addressing the same topic, included David Maidment, Hussein M. Alharthy Centennial Chair in Civil Engineering at the University of Texas at Austin; Dan Hardin of the Texas Water Development Board; and Alan Dutton, WIT assistant director and chair of the UTSA Department of Geological Sciences.

Robert Gulley, recently retired executive director of the Habitat Conservation Program at the Edwards Aquifer Authority, provided a keynote presentation on the history of the water regulatory environment. Additional experts speaking about water regulation included Robert Puente, CEO of the San Antonio Water System; Suzanne Scott, general manager of the San Antonio River Authority; and Francine Romero, associate dean of the UTSA College of Public Policy.

"The importance of the issue cannot be overstated given the vital role of water in the future growth and prosperity of the San Antonio metropolitan area," Papagiannakis said.

Winding up for Wind Energy Research

by KC Gonzalez

Although wind resources in the U.S. are abundant, the cost of generating wind energy is still prohibitively expensive when compared to natural gas and fossil fuels. Researchers have documented that one of the key reasons the costs remain high is because wind turbines have shorter lifespans compared to other energy-producing technologies, which can be directly linked to wear and tear caused by turbulence.

Turbulence, which is often associated with bumpy airplane rides, is the primary reason that wind turbines do not perform at their optimal capacity. In a wind farm, or cluster of wind turbines, turbulence occurs from multiple physical processes arising from the wind, atmosphere, complex terrain and the rotor blades.

Finding a solution to this problem is precisely what UTSA researcher and assistant professor of mechanical engineering Kiran Bhaganagar plans to do with the support of three National Science Foundation (NSF) grants. Bhaganagar graduated from Cornell University under the tutelage of John Lumley, a legend in turbulence, and has years of experience mastering the fundamental physics and mathematical framework of turbulence.

Totaling $400,000, the grants will allow Bhaganagar and her team of undergraduate and graduate students to pursue critical wind energy research on both land-based and offshore wind turbines to determine the optimal mechanical and aerodynamic conditions of the turbines.

“Our ultimate vision is to contribute to lowering the cost of generating wind energy by working with industries and federal agencies on what we discover is the most effective design and placement of turbines over complex terrains,” says Bhaganagar.

This is the first time that a scholar in the UTSA Simulation, Visualization and Real-time Prediction (SiViRT) Center will study wind energy. Scholars in the UTSA SiViRT Center use computer simulation, high-performance computing, and advanced visualization to research various topics in engineering and science with broad applications.

“Receiving NSF grants is important to UTSA as they invest in high impact research of intellectual quality and excellence in education,” said interim UTSA College of Engineering dean Mehdi Shadaram. “Professor Bhaganagar is leading an important new research initiative for the college that will attract and generate top quality students.”

Using advanced computational modeling, the team will generate one of the first accurate representations of the detailed aerodynamics of tall, multi-megawatt, rotating wind turbines. The model will simulate 24-hour atmospheric conditions over complex terrains to accurately predict the power output from a wind farm. The simulations will be performed on a 6,400-node Stampede Cluster, one of the most powerful supercomputers in the world.

Preliminary studies by Bhaganagar’s team have revealed that wake effects of the turbines upstream significantly affect downstream wind turbines, reducing their power by roughly 40 percent. The wake effects are cumulative so each additional downstream turbine performs less and less efficiently.

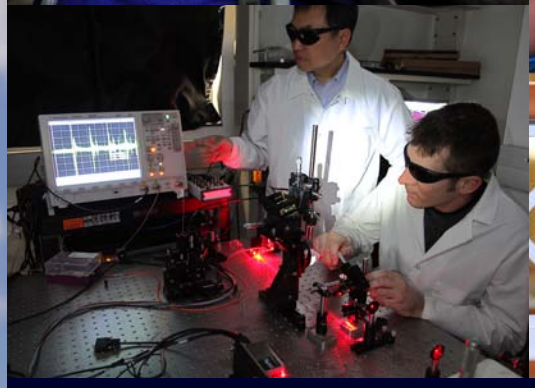
Their research is expected to greatly enhance the fundamental science of wind engineering and the future of wind farm installations.

As one of few females in a historically male-dominated field, Bhaganagar encourages more young women to pursue careers in engineering.

“One of my goals is to motivate and train young females in wind energy so that they can be a part of the solution to the world’s energy crisis and an impending issue facing our country.”

Bhaganagar will conduct the research in partnership with the National Renewable Energy Laboratory and the National Wind Resource Center at Texas Tech University. Bhaganagar has also established strong ties with the Technical University of Denmark, the world leader in wind energy research.

Wind, one of the world’s oldest sources of energy, is increasingly becoming a viable alternative to traditional energy sources. Texas is home to more wind power capacity than any other state in the U.S., approximately one-third of the nation’s total wind installments. Texas also consumes more energy than any other state in the U.S.



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At the University of Texas at San Antonio's College of Engineering, individuals, like Joseph (pictured on the left) earn a quality education necessary to excel in traditional and emerging areas of technology. However, there is more to being an engineer than labs and classrooms. Check out the QR code below to see Jospeh's story and the stories of others like him.

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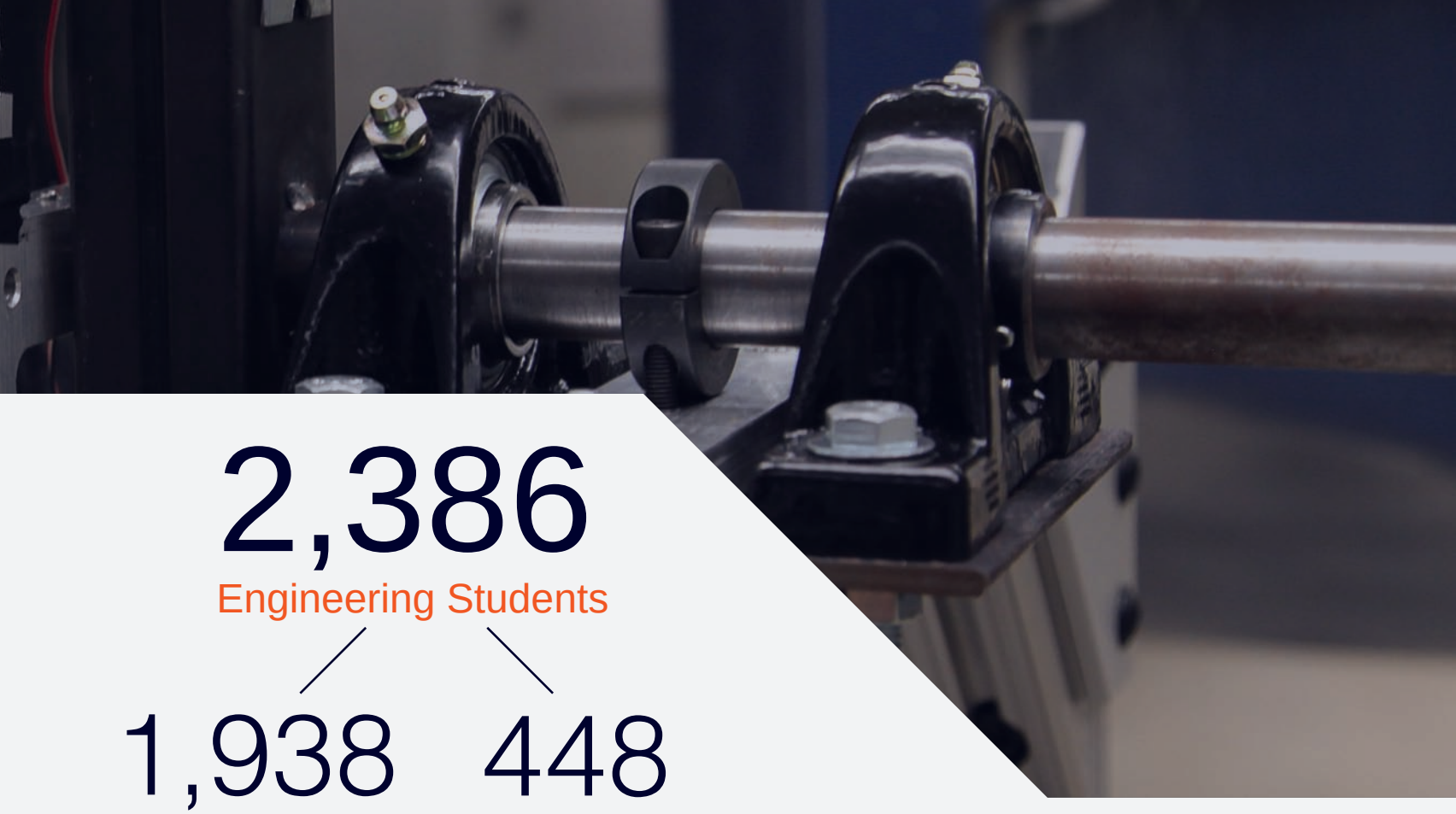
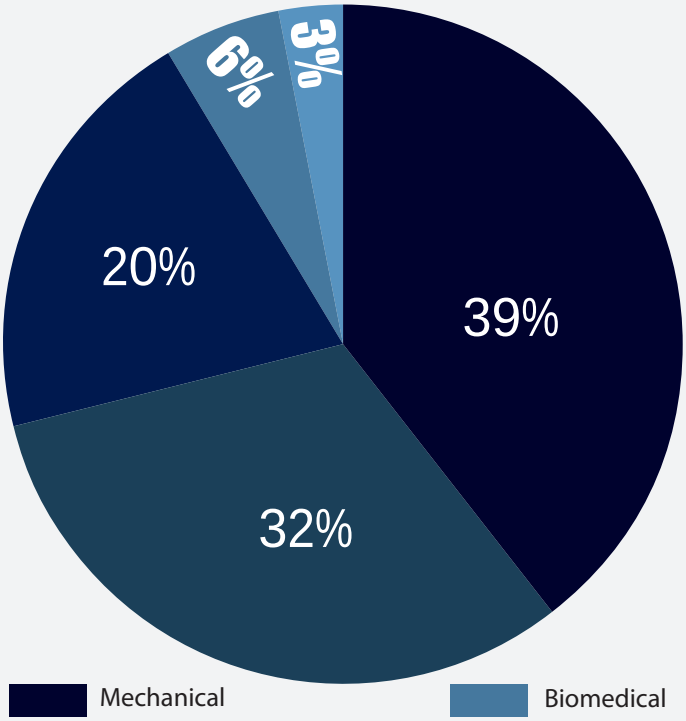


2,386
Engineering Students

1,938
Undergraduate

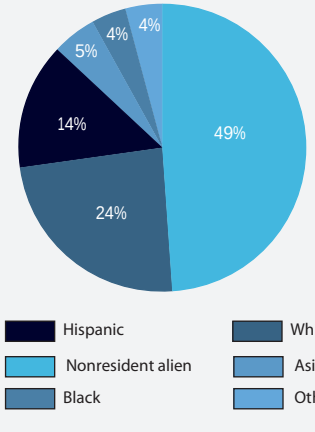
448
Graduate

COE Division by Major

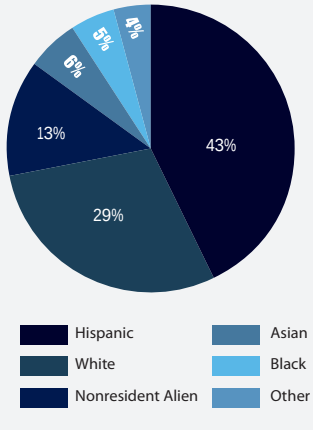


$6.25 Research Awards MILLION

Graduate



Undergraduate



ADVISORY COUNCIL

a message from the

COLLEGE OF ENGINEERING

ADVISORY COUNCIL CHAIRMAN

Walter D. Downing, P.E.

Executive Vice President, Southwest Research Institute

On behalf of the UTSA College of Engineering Advisory Council, it is my pleasure to write this message to the readers of Innovations magazine and to announce several changes that have taken place over the last six months.

Sam Dawson, the former Chair of the Advisory Committee led the council with distinction over the past five years, and I am happy to say that Sam will continue to serve on the UTSA College of Engineering Advisory Council, as well as, chair the Engineering Advisory Council at his alma mater, The University of Texas at Austin. I would like to formally thank Sam for his vision and leadership of the council and look forward to his continued support as we strive to move UTSA and the College of Engineering to Tier One status.

Another noteworthy change is Dr. Mauli Agrawal's selection as interim vice president for research at UTSA after serving as dean of the College of Engineering for nearly eight years. Under Agrawal's leadership, the college's annual research expenditures increased dramatically from $1 million to $14 million. Additionally, he recruited faculty from top universities around the world, and student enrollment grew by more than 50 percent, putting UTSA on the map as the fastest-growing engineering program in the state. Agrawal will remain a faculty member in the College of Engineering, continuing to teach and conduct research. I would like to thank Dr. Agrawal for his energetic and inspired leadership of the college and look forward to continuing to work with him.

Meanwhile, Dr. Mehdi Shadaram, College of Engineering associate dean for Student Affairs and Policies, became the interim dean of the College of Engineering. Shadaram holds the Briscoe Distinguished Professor position in electrical and computer engineering and serves as founding director of the Center for Excellence in Engineering Education (CE3). Under his leadership, the college has established successful partnerships with area schools to improve science and math education and increased community outreach has been an ever present goal.

I am delighted to report a committee has been organized to search for a permanent dean of the College of Engineering. The search committee, led by Dr. George Perry, dean of the UTSA College of Sciences, plans to have the new dean selected by April 2014.

It is clear that change continues to be a dominant theme at UTSA. Now is the time to ensure it is change for the better. All of us on the College of Engineering Advisory Council are committed to do our part to make this happen, and we call upon you to join us in building an even better future for the College of Engineering.

Dean's List

Spring & Summer 2013

The Dean and faculty of the College of Engineering congratulate the following undergraduates for making the Dean's List. To attain this honor, these students achieved a 3.75 or higher grade point average while registered for the spring or summer semesters of 2013 and been full-time students.

ELECTRICAL ENGINEERING

Bendele, Brian	SR	Hower, Bryce	SR
Briseno, Salome	SO	Johnson, Clark	SR
Brown, Matthew	SR	Jonguitud, Oscar	SR
Canty, Anngelique	SR	Kocian, Garrett	SR
Castillo, Granet	JR	McGee, Ross	SR
Davis, Jamal	SR	Myers, Robert	SR
Desai, Neel	SR	Najera, Ivack	SR
Downs, Richard	SR	Ozuna, Evan	JR
Esquivel, Edward	JR	Perez, Victor	SO
Gankov, Stanislav	JR	Ramirez, Ricardo	SO
Garcia, Ricardo	SR	Rios, Heleodoro	SR
Gruenberg, Kyle	SR	Spikes, Clarence	SR
Harm, Curtis	SR	Zuniga, Miguel	SR

BIOMEDICAL ENGINEERING

Abbott, Jenna-Leigh	SO	Isaac, Kameel	SR
Aguero Villarreal, Victor	JR	Komplin, Michael	JR
Alanis, Melisa	SR	Marchand, Brenda	SR
Arriaga Flores, Daniela	JR	Muse, Leah	SR
Basanez, Xabier	SR	Rodriguez, Adan	JR
Brandt, Rachel	SO	Rodriguez, Rebekah	SR
Hernandez Molina, Alejandra	JR	Zhang, David	JR

CIVIL ENGINEERING

Almosilem, Yousef	JR	Matejowsky, Chris	JR
Alnajdi, Khaled	SR	Mueller, Mason	SR
Alsaif, Faisal	SR	Ondarza, Rogelio	SO
Alshatti, Fahad	JR	Ozuna, Iris	JR
Alsuwidan, Khaleefa	SR	Perry, Jessica	SR
Choate, Trevor	SR	Picasso, Lasaro	SR
Clark, Derek	SR	Reyes, Augustine	SR
Corona, Livier	SR	Sadeqi, Yousuf	JR
De Greef, Angela	SR	Schmidt, Kevin	SR
Doria, Rick	SR	Schwille, Katherine	SR
Endsley, Randal	SR	Spengler, Bruna	SR
Faust, Louis	SR	Sun, Hongye	JR
Jaramillo, Joseph	SR	Wilkinson, Andrew	SR
Kircus, Zachry	SR	Woodruff, Jackson	SR
Lopo, Sylvia	SR	Zapata, Jesus	SR
Martinez, Samantha	SR		

COMPUTER ENGINEERING

Francia, Carmina	SO	Lwowski, Jonathan	JR
Harris, Anthony	SR	Peters, Kamaria	JR
Jauregui, David	SR	Teh, Ker Chin	JR

PRE-ENGINEERING/ UNDECLARED

Carrington, Dominique	SO	Turrubiates, Ruben	SO
Carroll, Christopher	JR	White, Garrett	JR
Cordova, Carol	SR	Perez, Gabriela	SO

MECHANICAL ENGINEERING

Abreu, Juan	JR	Humphrey, Brian	SR
Ahmadi, Alireza	SR	Jones, Clinton	SR
Alanis, Damian	SR	Kelm, Matthew	SR
Aldeyain, Abdulaziz	SR	Laureano, Julio	JR
Alenezi, Bader	SR	Lawrence, Devon	SR
Ameperosa, Ezra	SR	Li, Suhang	SO
Badshah, Huzeifa	SR	Maldonado, John	SR
Beavers, Jesse	SR	Mancuso, Peter	SR
Been, Michael	JR	Martini, David	JR
Beisert, Austin	SR	Naranjo, Austin	JR
Bodling, Andrew	SR	Palacios, Adam	SR
Carpenter, Clark	SR	Pennington, Preston	SR
Coleman, Matthew	SR	Ray, Geoffrey	SR
de la Garza, Raquel	SR	Roberts, Preston	SR
DeSamaniego, Jairo	SR	Singa-Craddock, Germain	SO
Didion, Michael	SR	Smith, Andrew	SR
Estrada, Maximilian	SR	Speer, Nicholas	SR
Evans, Daniel	JR	Stubbs, Colin	SR
Gutierrez, Eliud	SR	Trevino, Christian	SR
Hamed, Adam	SO	Varley, Daniel	SR
Hanna, Logan	JR	Ward, Joshua	SR
Harbaugh, Robert	SR	Zaveri, Sagar	SR
Heaps, Aaron	SO		
Hornseth, Kyle	SR		

PRESIDENT'S LIST: STUDENTS WHO ACHIEVED A 4.0 G.P.A.

Alanis, Melisa	Chavez, Celeste	Gruenberg, Kyle Matthew	Mannion, Dylan Jeffry	Rolater, Gregory Scott
Alazmi, Mohammed A B M H	Chiou, Geoffrey	Guglielmo, Tyler Hardy	Momin, Zaynilabidin Zulfiqar	Schwartz, Brandon Paul
Alvarez, Carlos Yovanni	Cruz, Joe Angel	Henk, Shane	Morales, Kathlene Rose	Vogler, Ryan Craig
Andrade, Paolo Alexander	Cruz, Ramos Adrian	Hurtado, Frank Anthony	Morsy, Fred Hatem Salem	Whitehouse, Joseph Michael
Arinze, Chukwunonso Bennard	Espinosa, Poulat Diego	Janssen, Thilo	Mosely, Levi James	Williams, Taylor Alexandra
Badshah, Huzeifa Ismail	Fajardo, Pablo G.	Kodinariya, Shrey S.	Pena, Mark W.	Zahrooni, Behdad
Basanez, Xabier Ignacio	Fox, Matthew Thomas	Krause, Ryan Jordan	Plunkett, Christian Joy	Zaragoza, Gabriel
Bishop, Connor Ryan	Gomez-Farias, Armando	Lance, Nicholas Taylor	Quirem, Saddam Jamil	
Byers, Steven J.	Gonzales, Thomas George	Linwood, Chelsea Monae	Ramirez, Ricardo	
Cabrera, Ana Patrizia	Gonzalez, Javier	Lloyd-Reilley, Jack	Rodriguez, David Arthur	
Castro, Marc	Green, Hector Alexander	Lochte, Frederick Charles	Rodriguez, Victor Craig	

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What's New In Your Life?

We want to hear about our alumni. Keep us informed on what's been happening in your life. Perhaps a new job, exciting travel, or new projects. We would love to share the news with your classmates and give current students a glimpse into the life of a College of Engineering graduate. Send your stories and photos to Tim.Luukkonen@utsa.edu.

Roland Rea and David Finnie, class of 1984, pose next to their original class photo during the UTSA Engineering Program's 30th anniversary dinner.